American Machinist

Volume 59 NEW YORK, SEPTEMBER 6, 1923 Number 10

Special Tools in the Great Northern Shop

By FRANK C. HUDSON

Aiding repair work by special devices — Speed-reducing mechanisms for portable pneumatic drills—Gage for pedestal binders—Self-contained roller tool

THE SHOP of the Great Northern Railway, located at Hillyard, just outside of Spokane, Wash., has a large number of interesting tools and other devices to help in getting repair work through the shop. There seems to be a particularly good spirit of co-operation in this shop, which probably accounts in a measure for the number of such tools.

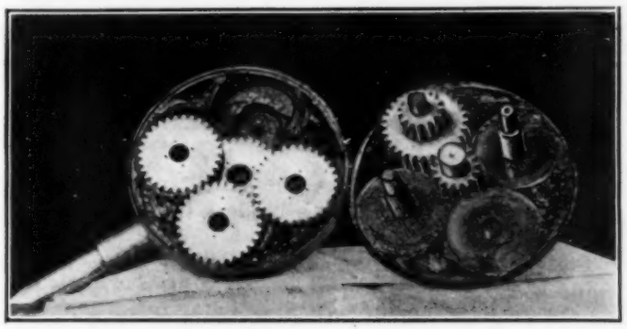


FIG. 1—GEARING OF A REDUCING MOTION

One of these tools is a speed-reducing mechanism for use in connection with portable pneumatic drills, so that they can be used to apply power at points where slow speed is required. The speed of the drill is reduced sufficiently to make the tool suitable for comparatively slow-moving machines.

In Fig. 1 can be seen the main gear case at the left. The cover is at the right with the driving pinion in the center and one of the reducing gears at the top. It can readily be seen how this cover fits over the case, which is normally packed with gear grease.

Referring to Fig. 2, we see the driving pinion at *A*, and the four main driven gears at *B*. These gears also carry the pinions *C*, which in turn drive the final gear *D*. The gears are all 10 pitch, and as the driving pinions have 15 teeth and the driven gears 30 teeth in each series, there is a 4 to 1 reduction, so that the driving spindle *E* runs at one-fourth the speed of the shank *F* which goes into the spindle of the air drill.

Another device for reducing the speed of an air drill is shown in Fig. 3; it is used for applying power to a screw for drawing cylinder bushings into place in rebored cylinders. This device consists of a worm and wormwheel mounted in a suitable case, the driving shaft being extended so as to be conveniently reached when the device is in position on the locomotive. The reducing device is made in two sizes, the smaller one

FIG. 3—WORM GEAR PULLER FOR CYLINDER BUSHINGS

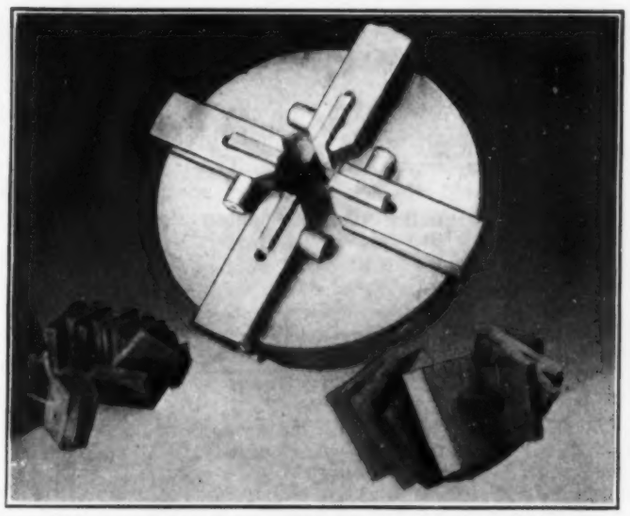


FIG. 4—CHUCK FOR RECUTTING BOLT CHASERS

for valve bushings having 54 teeth and the larger size for cylinder bushings, 90 teeth. As the worms are both single-thread, they give a speed reduction of 54 to 1 and 90 to 1, respectively, both working out well on their particular jobs.

When the cutting edges of the thread chasers in bolt-

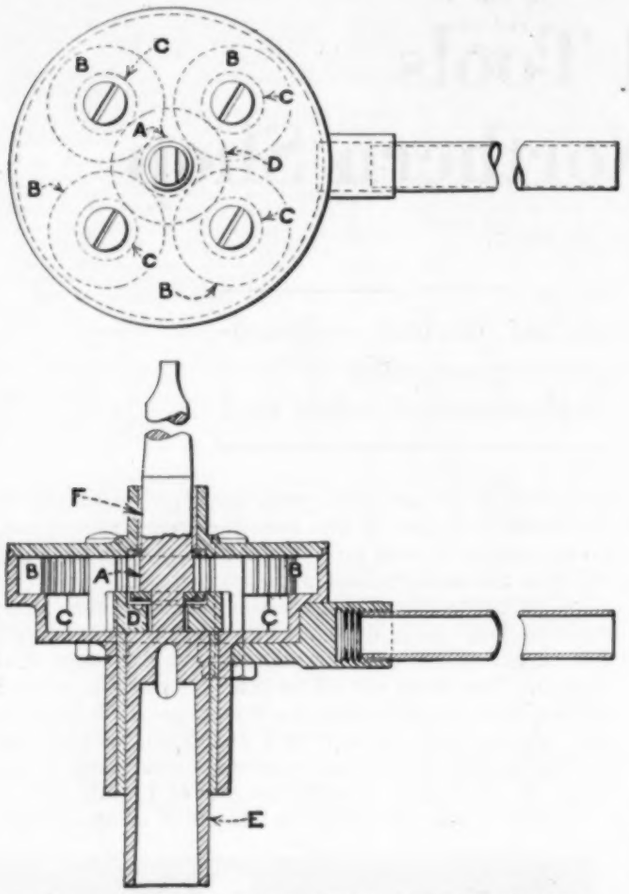


FIG. 2—DETAILS OF AIR DRILL SPEED REDUCER

cutting dies are worn out, the chasers are salvaged by annealing, removing the original thread and recutting in the chuck shown in Fig. 4. These chuck jaws are slotted to hold the chasers, the special filister-head screws shown being used to clamp them in position in the chuck jaws. These jaws are independent, and are graduated, so that the chasers can be set to any desired size for recutting. The reclaimed chasers are strung on wires according to their pitch, as shown, and are kept in the toolroom until needed at the bolt cutters.

A very useful gage for fitting binders on frame pedestals is shown in Fig. 5. In these days of large locomotives, the binder is so heavy as to be difficult to hold up against the pedestal jaws for laying out. With the gage shown, it is an easy matter to set the

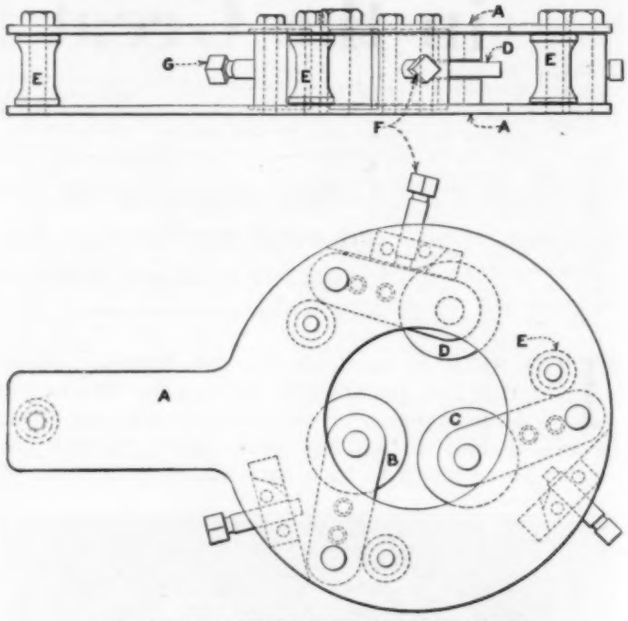


FIG. 6—SELF-CONTAINED ROLLER TOOL

plates *A*, *B* and *C* against the jaws, and in this way form a templet by which the binders themselves can be readily laid out on the bench.

Plates *A* and *C* can be adjusted to any desired angle, while *B* can be moved vertically as well as horizontally on the long bar which forms the beam or frame of the gage. Similar jaws and plates are fitted at the other end of the bar, and they have sufficient endwise adjustment so as to cover all types of locomotives. Details of construction are also shown.

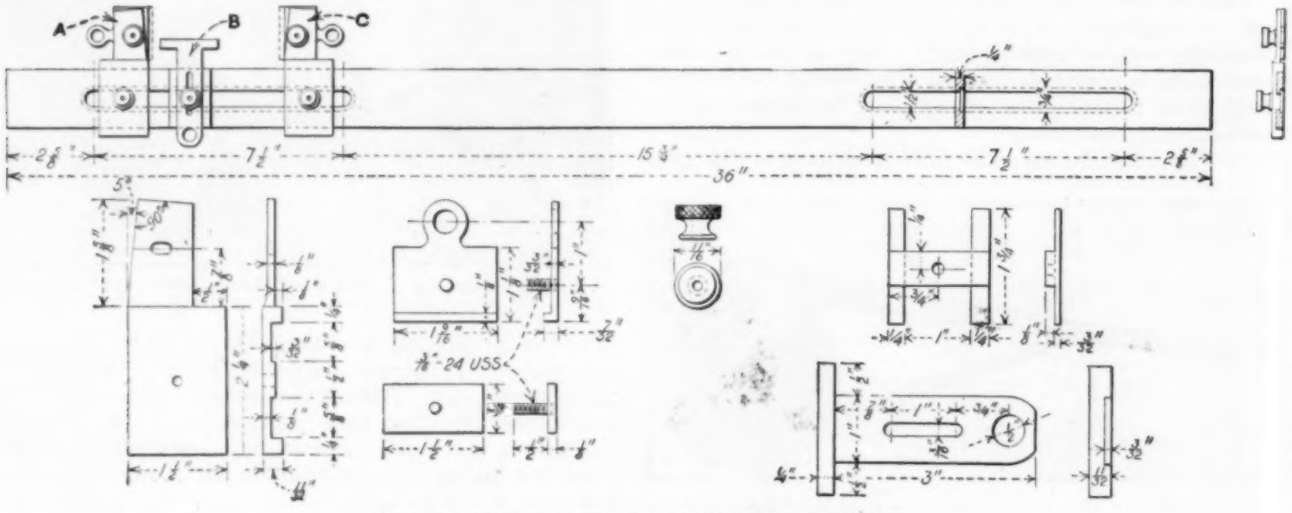


FIG. 5—GAGE FOR FITTING PEDESTAL BINDERS

The finishing of piston rods by rolling has become quite a common practice, but in most cases there is only one roller, which exerts its pressure not only against the piston rod, but against the lathe centers. An entirely different type of rolling tool is shown at Fig. 6, three rollers being held in a substantial frame, so that the tool is entirely self-contained and exerts no pressure on the lathe centers.

There are two side plates *A*, made of ⅜ in. boiler plate, 15 in. in outside diameter and having a 7 in. hole through the center. The overall length is 23¼ in., giving a lever arm 14⅝ in. long from the center of the opening to the center of the end bolt. The rollers *B*, *C* and *D* are 3⅛ in. in diameter by ⅝ in. face, and are turned with trunnions 1 in. in diameter and 1 in. long on each side. These trunnions are carried in forked arms built up in two pieces and fitted with hardened bushings. The two side plates are spaced by three thimbles *E* 2¾ in. long

The tool is simply slipped over the end of the piston rod, and the rollers adjusted by the screws *F* to give the desired pressure. The end of the holder rests on the tool block, and the movement of the carriage feeds the rollers along in the regular way. We are indebted to general foreman Colville and toolmaker Govett for these devices.

New Theories on Lubrication and Bearings

THE question of grooves in bearings for efficient lubrication is now regarded as settled by Dr. T. E. Stanton, Director of the National Physical Laboratory, England, and Chairman of the Lubrication Committee of the Department of Scientific and Industrial Research.

Dr. Stanton's lecture before the International Air Congress in London, went thoroughly into the whole question of efficient lubrication. He stated as the result of his research that:

Using an ungrooved journal and an ungrooved bearing, with castor oil as the lubricant, it was found that steady conditions could be obtained but that the coefficient of friction was 15 per cent *higher* than with the grooved surfaces and that substituting a grooved *journal* for the plain one did not improve matters. In the case of the Bayonne oil the increase in friction due to using ungrooved surfaces was 22 per cent.

It is clear, therefore, that a system of grooving is essential in order to obtain the minimum friction due to the materials of the surfaces and lubricant employed.

Particular stress was laid on the value of adding small quantities of organic acid to mineral lubricating oils. On this *The Engineer* of London comments: "The insufficiency of the Reynolds theory is in our opinion, presented by the known effect of adding small quantities of fatty acid to mineral lubricating oils. According to the hydro-dynamical view, the nature of the lubricant is immaterial, its viscosity alone affecting the result. Yet to take some figures recorded by Dr. Stanton, figures which are amply borne out by practical experience, the addition of 1 per cent of organic acid to Bayonne oil, an amount quite insufficient to have any noticeable effect on the viscosity, reduced the coefficient of friction in a bearing by no less than 17 per cent.

Dr. Stanton states:

During the last five years many modifications have taken place in the views held by engineers of the action between the lubricated surfaces of machines. The Reynolds theory of lubrication is so well known that I need hardly point out that the logical consequences of its acceptance are that the value of oils as lubricants depends solely on their viscosity, and that the nature and composition of the rubbing surfaces have nothing to do with the efficiency of the bearing. Curiously enough, the acceptance by engineers of these consequences has not been at all general.

Our experience during the last twenty years at the National Physical Laboratory has revealed a considerable demand for wear-tests on metals suitable for lubricated bearings and a general disinclination of clients to be convinced that when the lubrication was satisfactory, wear was impossible, and that one lubricant was as good as another so long as its viscosity was up to a given standard.

The existence of this feeling has been well brought out by Dr. Lanchester, who insisted that, from the days of the millwrights of last century, engineers of wide experience have been fully alive to the fact that animal and vegetable oils were superior as lubricants to mineral oils of the same viscosity, in virtue of some characteristic for which there was as yet no definite test.

It has become more and more certain, however, that there can exist between rubbing surfaces a condition of steady lubrication whose characteristics are totally different from that of the Reynolds type. The modern conception of lubrication is, in the main, due to the advances which have been made in the domain of physical chemistry with regard to the molecular phenomena occurring at the surfaces of solids and the manner in which films of foreign matter are condensed on these surfaces by the process known as adsorption. It is now recognized that solid surfaces having an adsorbed layer of lubricant of only one molecule in thickness, can slide over each other with comparatively small frictional resistance.

Further, it is known that adsorption is dependent upon the chemical constitution of the lubricant and that the greater the work done in the process of adsorption, the less the frictional resistance of the surface to sliding. Acids, alcohols and esters are more strongly adsorbed by water than are paraffins, and it is found that the former are better lubricants than the latter.

There are therefore two essential different kinds of lubrication: In one the surfaces are separated by a film of lubricant many hundreds of molecules in thickness, so that the resistance of relative motion of the surfaces is due to the lubricant in mass and the effect of the reactions at the two interfaces of lubricant and solid surfaces is negligible. In the other the molecular reaction at the common boundary constitutes the whole of the resistance, which is therefore a function of the nature of the surfaces and the chemical constitution of the lubricant. In the former case the frictional resistance is determined by the viscosity of the lubricant and by the relative speed, configuration and attitude of the rubbing surfaces.

It has been found by Prof. W. B. Hardy, that in this kind of lubrication which he has termed "boundary lubrication," the relation known as Amonton's Law, or the Law of Solid Friction, is strictly followed, i.e., the friction for a given normal pressure between the surfaces is independent of relative speed and area of contact. . . .

Several attempts have recently been made at the National Physical Laboratory to set up conditions under which boundary lubrication could be conveniently studied on an engineering scale. The first series of experiments of this kind were made on the well-known machine designed by Dr. Lanchester for testing the efficiency of worm gears. That the lubrication between the surfaces of the worm and worm wheel in these gears was essentially boundary lubrication, appeared to be certain from the results of the efficiency tests, which indicated a marked superiority of the animal and vegetable oils over the mineral oils as regards the temperature at which the gear could be run without a serious increase in the friction.

The experiments show that in general engineering practice, the lubrication of all machine details in which the

relative motion is of a reciprocating character, may be taken as boundary lubrication and that consequently in such cases the improvements in efficiency due to the addition of organic acids to the lubricants employed will be realized.

On the other hand, whenever steady relative motion of the rubbing surfaces can be maintained, it would appear to be possible by the use of a suitable lubricant and correctly proportioned surfaces, to set up a condition of film lubrication of the Reynolds type with its advantages.

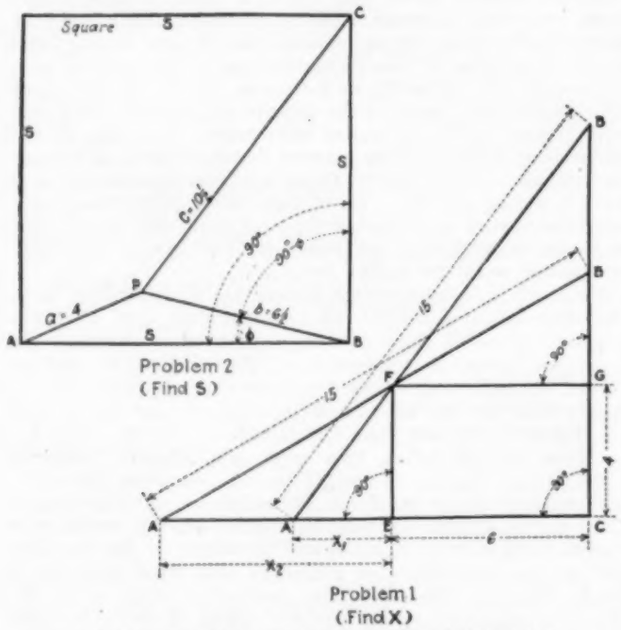
Further, the question of grooves in bearings which has given rise to so much controversy in the past may now, it is thought, be regarded as settled. It was found by Beauchamp Tower, that the presence of an oil groove in the crown of a bearing effectively prevented the formation of an oil film.

Trigonometry Problems from the Drafting Room—Discussion

BY WM. W. JOHNSON

HERE are complete solutions to the problems submitted under the above title by E. D. Thompson, on page 652, Vol. 58 of the *American Machinist*.

I do not know of any way to present the solution of a cubic or bi-quadratic equation so that it can be understood by the draftsman or shop man who does not understand the theory or solution of equations. When



LAY-OUTS FOR MATHEMATICAL PROBLEMS

only one root is required, as is usually the case with problems of a practical nature, Horner's method is usually the most satisfactory.

Referring to the figure illustrating Problem 1, the right triangles ABC and AFE are similar, since their sides are respectively parellel. Therefore,

$$AB:AF = AC:AE$$

But, $AB = 15$, $AC = x + 6$, and $AE = x$. Then,

$$AF = \frac{15\,x}{x+6} \qquad (1)$$

From the right triangle AFE,

$$(AF)^2 = x^2 + 4^2$$

Then,

$$AF = \sqrt{x^2 + 16} \qquad (2)$$

From equations (1) and (2),

$$\frac{15\,x}{x+6} = \sqrt{x^2 + 16}$$

Squaring both sides and reducing,

$$x^4 + 123x^3 - 173x^2 + 192x + 576 = 0 \qquad (3)$$

By trial we find that this equation has one rational root which is + 3. Therefore

$$x_1 = 3$$

Equation (3) may now be written

$$(x - 3)\ (x^3 + 15x^2 - 128x - 192) = 0$$

Then the other values of x may be found from the equation:

$$x^3 + 15x^2 - 128x - 192 = 0 \qquad (4)$$

Applying Descartes' rule of signs we find that the above cubic equation has one positive and two negative roots. The negative roots must naturally be disregarded in this problem. By trial we find that the positive root lies between 7 and 8. Applying Horner's method for incommensurable roots, we find the value of x_2 to be 7.0434. Hence, the distance x can be 3 or 7.0434.

The layout for Problem 2 is shown in the illustration. To derive a general formula we will consider the problem: Given the distances of a point in the plane of a square to three vertices, to find the side of the square. Let s = the side of the square, and P the given point. Referring to the figure, let $AP = a$, $PB = b$, and $CP = c$. Let angle $ABP = \phi$, and angle $CBP = 90° - \phi$. From the cosine formulas in trigonometry, we get

$$\cos\,\phi = \frac{b^2 + s^2 - a^2}{2bs} \qquad (1)$$

And

$$\cos\,(90° - \phi) = \frac{b^2 + s^2 - c^2}{2bs}$$

Now,

$$\cos\,(90° - \phi) = \sin\,\phi$$

Then,

$$\sin\,\phi = \frac{b^2 + s^2 - c^2}{2bs} \qquad (2)$$

Squaring equations (1) and (2) and adding them together, we have

$$\sin^2\phi + \cos^2\phi = \frac{a^4+2b^4+c^4+2s^4+4b^2s^2-2a^2b^2-2b^2c^2-2a^2s^2-2c^2s^2}{4b^2s^2}$$

From trigonometry we find

$$\sin^2\phi + \cos^2\phi = 1$$

Then,

$$4b^2s^2 = a^4 + 2b^4 + c^4 + 2s^4 + 4b^2s^2 - 2a^2b^2 - 2b^2c^2 - 2a^2s^2 - 2c^2s^2$$

Arranging terms, we have

$$2s^4 - 2(a^2 + c^2)\ s^2 + a^4 + c^4 - 2b^2(a^2 + c^2 - b^2) = 0$$

This is a quadratic equation in s^2. Solving for s, we get

$$s = \pm\sqrt{\frac{(a^2+c^2) \pm \sqrt{4b^2(a^2+c^2-b^2)+a^2(2c^2-a^2)-c^4}}{2}}$$

When the point P lies within the square take the plus signs before the radicals. Substituting numerical values we have $a = 4$, $b = 6\frac{1}{2}$, and $c = 10\frac{1}{2}$.

Then

$$s = \tfrac{1}{2}\sqrt{1{,}010 + 26\sqrt{503}} = \tfrac{1}{2}\sqrt{1{,}593.1192}$$

$s = 9.9785$, the length of the side of the square.

Automotive Service Methods and Equipment

By HOWARD CAMPBELL
Western Editor, *American Machinist*

Nineteenth article—Service operations in a Dorris station—Saving time with testing, reaming and riveting fixtures—Locating "knocks"—Greasing with a force pump

WHILE it is true that the market affords a great variety of automotive service machinery and tools, the wide-awake service manager will find many places in which he can save time and produce better work by making up special tools to fit his particular needs. The equipment of the Dorris Service Station, which is located at the plant of the Dorris

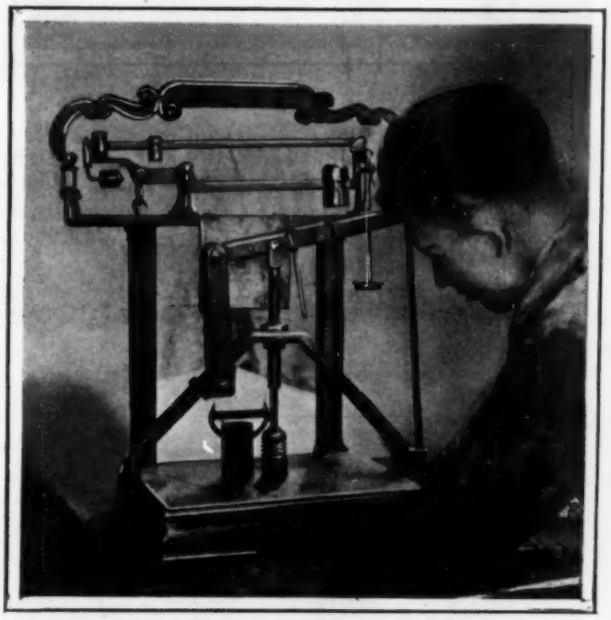


FIG. 1—TESTING VALVE SPRINGS

Motor Car Co., St. Louis, Mo., includes a number of tools that would be hard to find in a catalog, but which should prove interesting to every service man.

In order to put out high-quality work, it has been found expedient to test all valve springs before they are used. The operator shown in Fig. 1 is using a testing fixture which has been made from a small scale. An iron strap has been attached to the sides of the scale, coming up over the top of the platform in such a manner that it will form a support for a plunger which is attached to a hand lever. A cup-shaped piece is attached to the bottom of the plunger so that it will fit over the top of the spring when placed in the position shown in the illustration. Tests have been made which show that a valve spring should develop a pressure equal to 220 lb. when compressed to a length of 2 in. The round piece standing by the side of the spring is a gage which is used by the operator to tell when the spring is compressed to the proper length. The two marks on the gage indicate the proper lengths for passenger car or truck valve springs.

Every mechanic who has ever adjusted the brake band on a car knows what a job it is to get the band set to the right tension the first time. In order to make this operation as easy as possible, a brake drum *A*, Fig. 2, has been fitted with two handles and a section of it cut away so that when the wheel is off and the brake drum is placed in position under the band, the adjusting mechanism can be reached with a wrench. This makes it possible to adjust the brake band to the proper tension without difficulty, as it is only necessary to adjust it to a point where the drum can just be turned by hand.

Another handy, though simple, piece of equipment is the wooden block, *B*, shown resting under the axle of

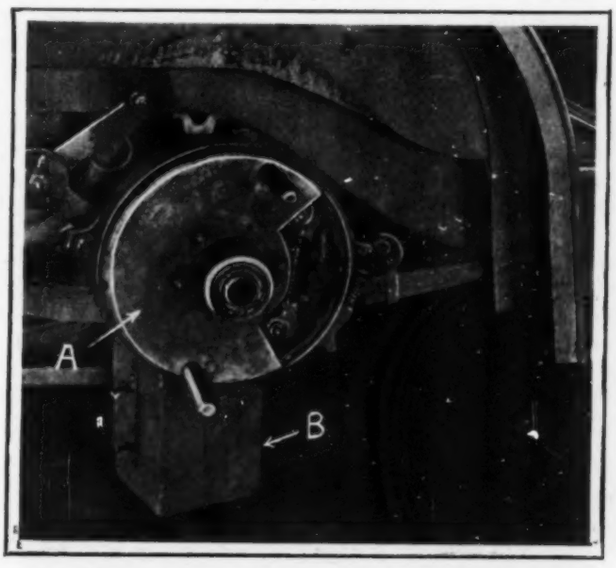


FIG. 2—GAGE FOR SETTING BRAKE BAND

the car. This is a hardwood block 10x10x12 in. high, with a handle on one side as shown. When it is necessary to raise the axle off the floor, the jack is used to raise the axle until one of these blocks can be slipped under, then the jack is removed. This releases the jack so that it may be used elsewhere, and also tends to safeguard the operators who are working on the car, as this block will not tip, whereas it may happen

FIG. 3—PISTON PIN VISE CLAMP

that a jack slips or tips over and lets the car down without warning.

The operator shown in Fig. 3 is fitting a connecting rod to a piston pin. The pin is held in a nut which has been faced off square on both sides, bored out until it is a slip fit over the pin, and then slotted through one side. By the use of this nut a piston pin can be gripped firmly without injury. This is used for fitting piston pins to connecting rods and also for fitting pistons to the pins.

Reaming Main Bearings

When new main bearings have to be put into a crankcase, the fixture and tools shown in Fig. 4 are used to align-ream the bearings after assembling. To the rear end of the crankcase is bolted a plate *A* which has a hole through the center to receive the end of the boring bar. The plate *B* on the front of the crankcase is located by plugs *C* and *D* which fit into the camshaft bearing hole and starter stud hole as shown. When the plugs are in position, the plate is fastened to the gear case cover cap holes by means of capscrews. The bearings are first bored out, using the bar *E* which is shown in position in the crankcase and then they are reamed, using the reamer lying on top of the crankcase. To bore the first bearing, which is the one in the plate *B*, the boring bar is reversed and operated from the back end of the crankcase. After the first bearing has been bored, one of the two steel bushings shown on top of the crankcase is placed in position, and the next bearing is bored. Both steel bushings are then brought into use to support the bar and keep the hole straight. The same procedure is used with the reamer bar. A crankcase can be bored and reamed complete in three hours with this outfit.

A fixture and tools for reaming connecting rods are shown in Fig. 5. The connecting rod is put into the

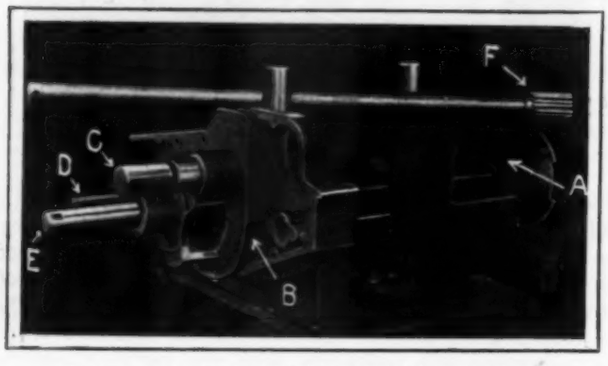


FIG. 4—MAIN BEARING REAMING FIXTURE

fixture in the position shown, with the hole in the small end of the rod resting over a locating pin, and with the large end of the rod in the fixture. The piece *A* is then inserted into the fixture to centralize the hole in the large end of the rod. The upper part of the piece *A* is ground to a sliding fit in the hole in the fixture and the lower end is hollowed out and slotted as shown so that it can be adjusted to slide far enough into the holes in the large end of the rods to centralize them, even though the hole in the rods may vary somewhat. The head of the bolt shown protruding from the

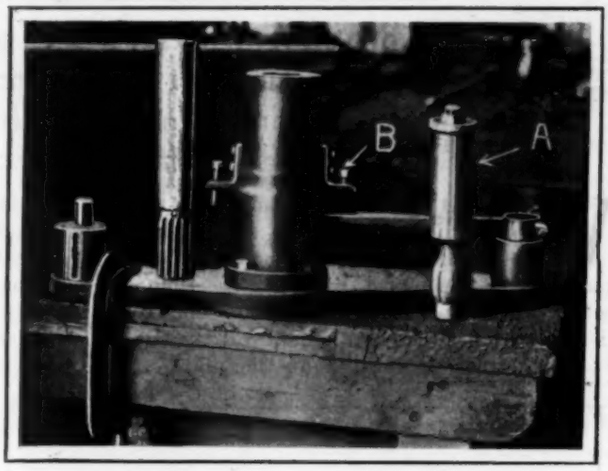


FIG. 5—CONNECTING ROD REAMING TOOL

top of the piece is recessed on the under side so that when the nut on the upper end of the bolt is tightened, the lower end of the piece will be compressed to the desired diameter. When the rod is located in the proper position, the screw *B* is tightened against the rod to hold it in position while the reaming is done. Another boss with a locating pin for the small end of the rod is shown at the left side of the fixture. This is to take care of a rod of a different length.

A home-made tool for riveting the lining to clutch

FIG. 6—RIVETING LINING TO CLUTCH PLATE

plates is shown in Fig. 6. The principal part of the tool consists of a C-clamp to which is riveted a section of hexagon steel bar to provide a means of holding the tool in the vise. That part of the clamp which was threaded for the setscrew has been bored out to

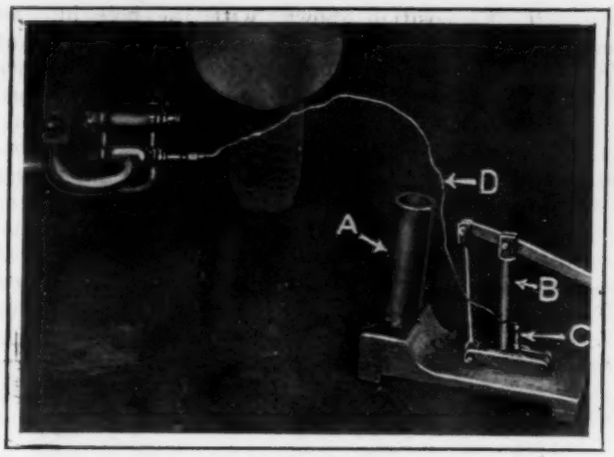


FIG. 7—GREASE PUMP FOR SPRING BOLT

receive a coil spring as shown. A hexagon piece with a hole through it for the plunger has been threaded and screwed into the under side of this hole to serve as a seat for the spring. The lower end of the plunger has been hollowed out to produce the desired head on the rivets, and as the lever is long enough so that plenty of purchase is obtained, a very good job can be done.

The apparatus shown in Fig. 7 is a pump for forcing grease into spring bolts. It sometimes happens that

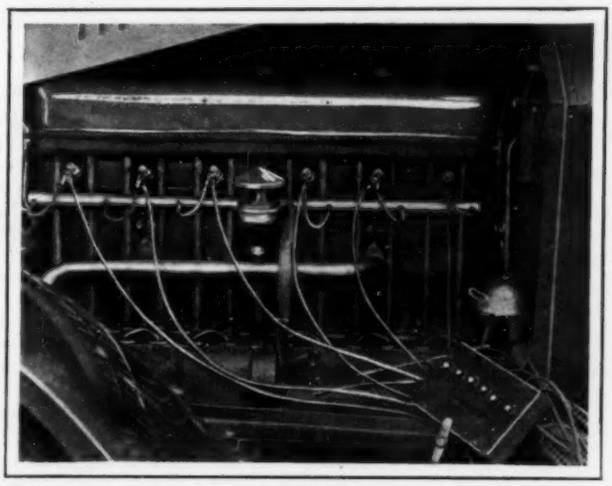


FIG. 8—CYLINDER CUT-OUT WEARING BLOCK

the grease hole in a spring bolt becomes so clogged with dirt that it is impossible to get grease into it by the usual methods. Usually, the only alternative is to remove the bolt from the car and place it in the vise where the hole can be opened. The device consists of a wood base carrying an oil-reservoir *A* which consists of a section of 2½-in. brass tube 8 in. high and closed at the bottom. The piece *B* is a steel sleeve with a vertical ¼-in. hole in it to receive a section of steel rod which acts as a plunger. The plunger hole is connected with the piece *A* by a section of tubing on the under side of the base. A check valve in this section of tubing allows oil to be drawn from the reservoir *A* when the plunger is raised but closes immediately when the plunger is started downward and prevents the oil returning to the reservoir, thus making it necessary for it to enter the tube *D*, which is ¼-in. copper tubing. An ordinary pipe connection is soldered to the end of this tubing so that it can be attached to the spring bolt, as shown. It is said that enough pressure can be applied to the oil with this device to split open the tubing, and that practically any spring bolt oil-hole can be opened with it.

It sometimes happens that a "knock" can be heard in the motor, but which is hard to locate. By using the apparatus shown in Fig. 8, the mechanic can drive the car and at the same time cut out one cylinder at a time, until the knock is discovered. The apparatus consists of a wooden block, in which are located six push-button switches, each switch being connected with a wire which can be attached to the spark plug of a cylinder, as

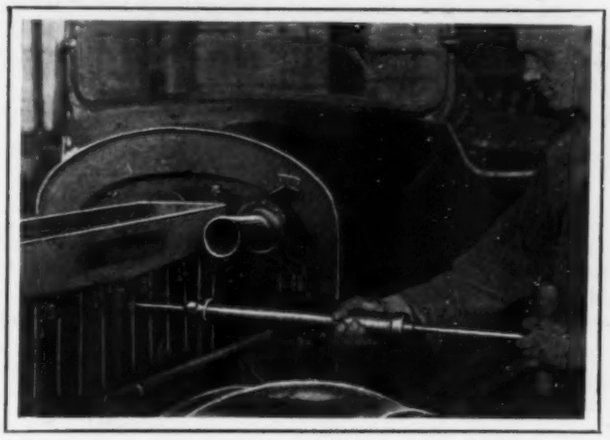


FIG. 9—SUCTION PUMP FOR LOCATING KNOCKS

shown, and all six switches being attached to a seventh wire which is grounded on the motor. By pressing one of these buttons the spark plug with which it is connected is connected to the ground wire, the plug will not fire, and if that particular cylinder is the one in which the knock is located, it will be discovered by its absence. This is a very handy apparatus, as sometimes knocks can be heard while the car is in operation on the road which cannot be located when the car is standing in the service station, as would be expected.

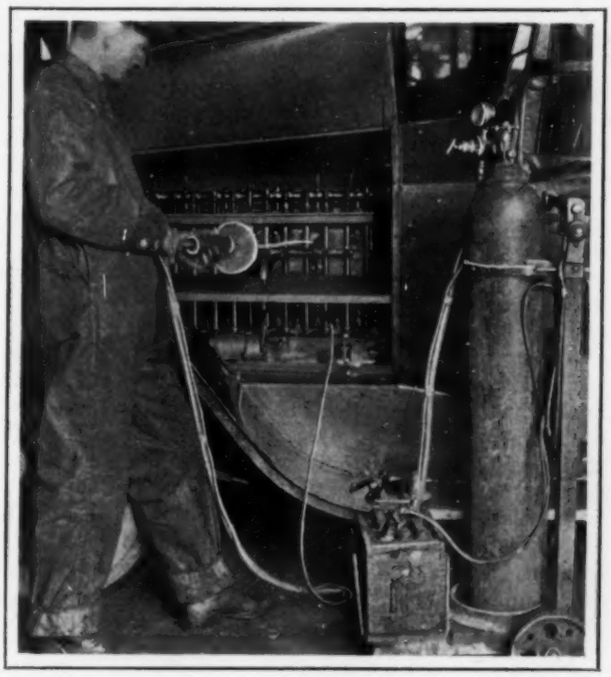


FIG. 10—BURNING CARBON OUT OF CYLINDERS

Another tool for locating knocks, and a very handy one, is shown in Fig. 9. This is a pump made of a section of 2-in. brass tubing 12 in. long with a flange on each end. To one end is attached a pipe nipple which is threaded on the outer end so that it will fit the thread in the spark-plug hole, and the plunger, of course, operates in the other end. The plunger consists of a section of steel rod with a round leather piece on the end which fits tightly in the tubing. As each cylinder is practically an airtight chamber, when the nipple of this pump is screwed into the spark-plug hole and the plunger of the pump is withdrawn, a vacuum is created which lifts the piston. By pulling and pushing the pump plunger back and forth, if there is any looseness in the piston or connecting-rod bearings, it can usually be detected.

The outfit for burning the carbon out of cylinders, shown in Fig. 10, is one with which practically all service men are familiar. The interesting feature of this particular outfit is, however, that no matches are needed to ignite the gas. A storage battery is fastened to the platform of the truck which carries the gas tank, one of the wires from the storage battery being attached to the rear end of the gas torch, the other one being grounded on the motor. A push-button switch is located just back of the torch handle, so that when the button is held down and the end of the torch is touched to the cylinder, a complete circuit is formed. By inserting the end of the torch in the spark-plug hole and rubbing it on the edges of the hole, sparks can be made to fly, and if the gas is turned on at the same time it can easily be ignited. This saves a lot of time and trouble, and experience would indicate that it is absolutely safe.

Methods of Testing Materials

The committee of the American Society of Testing Materials on the methods of testing, reported to the 26th annual meeting, held at Atlantic City, June 25 to 29, 1923, along the following lines: It is believed that the policy of studying methods from a broad viewpoint will lead to the organization of permanent subcommittees to consider tests of a certain type, such as tension, compression, distillation, etc. Several committees have carefully reviewed methods submitted a year ago, and a number of new methods representing considerable study and effort, are being brought forward. Discussions during the year have shown that consideration of methods of tests will be greatly facilitated if original test data that served as a basis in the formulation of the methods, are made available. The Committee suggests the desirability of requiring that standing committees include in their reports, the principal data upon which methods of tests have been based.

Defining Stress and Strain

As a result of criticisms and suggestions, some changes have been made, principally in the definition of "stress" and "strain," on which there seems to have been some misunderstanding. Textbooks on physics and some European textbooks on mechanics of materials, give a definition substantially the same as the Committee now recommends, which is "The intensity per unit area of internal force which, in the presence of forces causing a change in the form of a body, tends to hold the particles in their original relation and to preserve the integrity of the body." American textbooks on engineering mechanics define stress as a *force*, measured in pounds, and they call the intensity of force "unit stress" or "fiber stress."

In view of the fact that even in engineering textbooks the term "stress" is often used to denote intensity of force per unit of area, and in view of the fact that the physicists' definition involves somewhat simpler terms, the latter has been followed by the committee. In a similar way, strain has been defined as "The change per unit of length in the linear dimensions of a body, which change accompanies a given stress." Here again, the physicists' point of view has been followed as distinguished from the usual definition in engineering textbooks in which "strain" is used in the sense of total deformation.

The proposed tentative definition of terms relating to methods of testing, and which are published primarily for the purpose of eliciting criticism and suggestions are:

Tension—The condition which exists in a body subjected to forces which tend to pull the body apart.

Compression—The condition which exists in a body subjected to forces which tend to bring closer together the particles of the body.

Shear—The condition which exists in a body subjected to forces which tend to cause two contiguous parts to slide relatively to each other in a direction parallel to their plane of contact.

Flexure—The condition which exists in a body subjected to forces which tend to change the curvature of the axis of the body.

Torsion—The condition which exists in a body subjected to forces which tend to cause rotation about the axis of the body of a cross-section with reference to a contiguous cross-section.

Stress—The intensity per unit area of the internal force, which, in the presence of forces causing a change in the form of a body, tends to hold the particles in their original relation and to preserve the integrity of the body. Stress is measured in pounds per square inch (kilograms per square millimeter).

Strain—The change per unit of length in the linear dimension of a body, which change accompanies a given stress. It is measured in inches per inch of length (millimeters per millimeter).

A Stress-Strain Diagram—A diagram plotted with values of stress as ordinates and values of strain as abscissas.

Elastic Limit—The greatest stress which a material can withstand without deformation which remains upon release of the load.

Yield Point—The stress in a material at which there occurs a marked increase in strain without an increase in stress.

Tensile Strength or *Ultimate Tensile Strength*—The maximum stress carried by a test specimen in a tension test to rupture.

Modulus of Elasticity—The ratio, within the elastic limit of a material, of stress to corresponding strain.

Mechanical Analysis of Foundry Sand

A mechanical analysis was recently made, using the air analyzer of the Bureau of Standards, of a sample of foundry sand which contained coal particles and coal dust. This sand had been sent with a request for some method of removing the coal so that the sand could be used again in the foundry. The results of the mechanical analysis indicated that the coal could not be effectively cleaned out of the sand by means of air separation. It is probable that in cases of this kind some method of washing must be used.

It Pays to Replace—

How a Shop Saved by Replacing Old Shop Equipment with New Equipment

By MALCOLM H. AMES
Tool Designer, Saco-Lowell Shops, Lowell, Mass.

This article won a $10 prize

IT IS often hard to get old equipment replaced as long as the finish on parts produced is satisfactory and the production sufficient. It is rather a common occurrence to be told, "We have only eighty pieces a day to get out and we can do that easily." That is a comfortable feeling to have, as long as you do not count the cost, and things often slide along unnoticed on that basis. However, when an assembly floor is held up for parts, something has to be done, and the results are likely to show that the old tools are eating up enough money to pay for the new equipment.

The tools described here are some of those used for machining the roll stand for a worsted spinning frame, shown in Fig. 1. The foot *A* of the roll stand is fastened to the beam of the frame. Directly over the foot is a bronze half bearing *B* that carries the front rolls. Behind the bearing is an ear *C* to which is fastened the horn *H*. The horn curves up over the bearing and serves to guide the tension rolls. Behind the foot and in line with the ear is a surface *D* that serves to line up the intermediate tension guides. Back from the ear, at an angle of thirty-six degrees with the foot, is a surface *E*, having a tongue slot through the middle, on which slide the carrier stands and back-roll stands. This surface has graduation marks 1 in. apart along the whole length, which is about 20 in. On the underside is a cast rack, by means of which the carrier stand *G* may be adjusted in or out, simultaneously, the whole length of the frame. The underside *F*, on the extreme end, is finished for bolting to the creel stand. In order to minimize fitting at assembly, these milled surfaces are held in close relation to each other. The old design called for fitting the bearing to the roll stand. By finishing the bearing separately and finishing the seat for it, interchangeability is secured with little difference in cost. The roll stand is of cast iron and is very light in section, so that care had to be taken in designing fixtures that would not spring it in clamping and would, at the same time, support it well under the cut.

The first operation is to mill the slide for the carrier stands. On the old equipment, four stands were held in a fixture on a special, four-spindle, vertical miller. The graduations were put in on the same machine by means of an extra cross-rail carrying a single-point tool, and an index device on the feed hand wheel. The old machine was too light and the fixture was slow to load, sprung the work, and did not support it properly. The feed had to be slow. The operator of this machine hammered in the bronze bearings while the milling was done, and the other operations on the bearing were done in place on the stand. Obviously this method was a disadvantage when the time came for replacement of bearings in the mills.

The new fixture, Fig. 3, is used with a Cincinnati index base, on a No. 2 Cincinnati vertical miller with

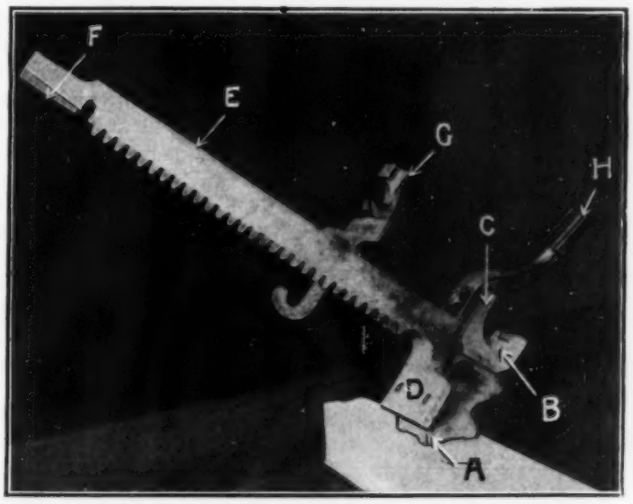


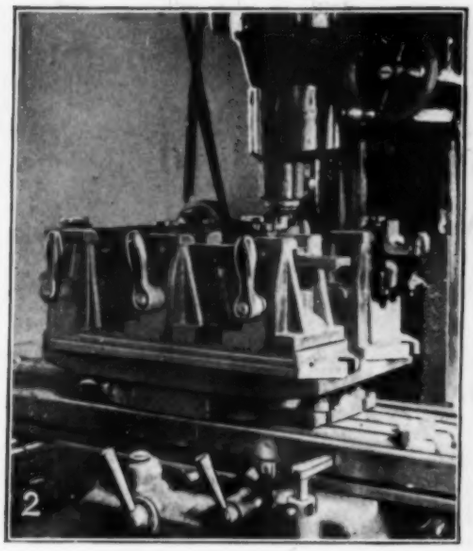
FIG. 1—THE ROLL STAND ON WHICH TIME FOR MACHINING OPERATIONS WAS CUT MORE THAN ONE-HALF

power rapid traverse. One piece is milled while the other is being loaded. The feed is much faster than the old machine would stand. The slight spring under the cut, which is unavoidable, is taken out by grinding at a later operation. The graduations are put in, after the grinding, by one stroke of a lever in a special marking device or fixture of our own design.

The second operation, milling the slot, was done on an old style vertical miller in a rather slow loading fixture. The new machine is another No. 2 Cincinnati vertical miller like the first and two fixtures are mounted on the index base as shown in Fig. 2. The work is loaded more easily and supported better. The old machine was run at such a rate that the slot could not be kept to size and had to be filed. We have cut down the rate so that we have eliminated the filing and we still beat the time of the old machine.

The third operation is to mill the foot and surface for the intermediate tension-guide support. The work

In the contest, which closed July 5, nine prizes were given for articles telling how a shop saved by replacing old shop equipments with new equipment. Additional articles will be printed in fortheoming issues.



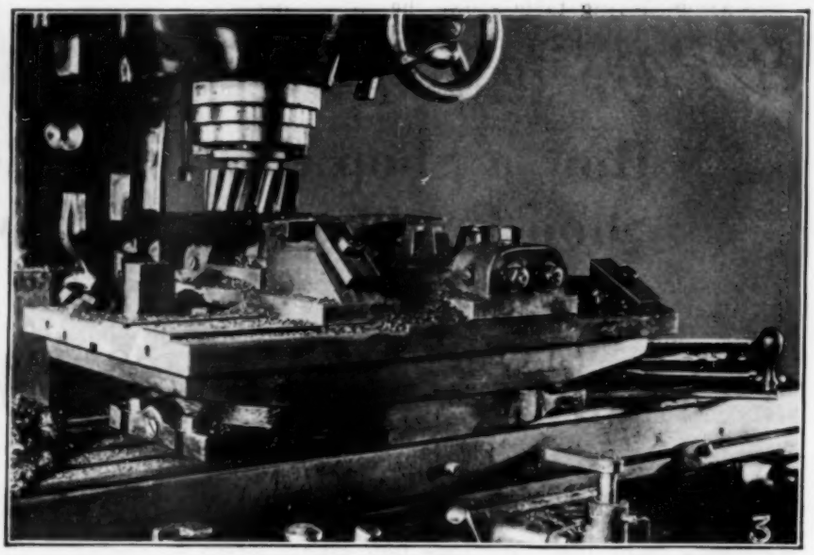


FIG. 2—OPERATION 2: MILLING SLOT. FIG. 3—OPERATION 1: MILLING TOP

in both the old and new fixtures is located on the surface and slot already milled. The old fixture carried six pieces, strung one behind the other. The set-up time was excessive as the whole six had to be set up and wedges were then driven between them. Even then the feed was very slow. In the new fixture one piece is done at a time. The work is clamped down on a tongued plate and is located lengthwise by bringing the ear against a stop. Plate, clamp and stop are on a gibbed slide, the Vs of which are perpendicular to the tongue on the plate. This arrangement allows the part to be brought to an equalizer on the solid jaw of the fixture and insures the surfaces being square with the tongue. A belt through to a strap on the front clamps the work and keeps the operator's hands away from the cutters. The part is held rigidly and with only two clamping points. The machine used is a No. 3 high-power Cincinnati miller with rapid traverse.

The fourth operation is to mill the tail. It was done by strapping the part to the milling machine table, doing one at a time. At present we clamp two pieces down on the table, clamping one while the other is being milled. In this way the cut is practically continuous. We intend later to provide a fixture for this operation. It will make handling easier and, by supporting the job better, will enable us to increase the feed. The machine is a No. 2 Cincinnati vertical miller with power rapid traverse.

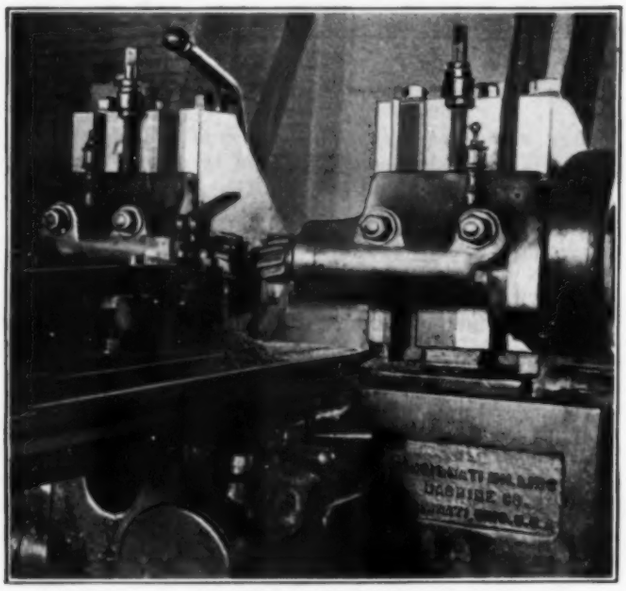


FIG. 4—OPERATION 5: MILLING END OF SLOT FOR BEARING

The fifth operation on the old design of part was to mill the ends of the bronze bearing. It was done by a large pair of straddle mills. The part was held by two straps on the same locating points that were used in the third operation. The present design of part has the ends of the slot for the bearing milled at this operation on the 24-in. Cincinnati duplex miller, as shown in Fig. 4. The part is centered by the tongue slot and is clamped to the foot and tail finishes by a single cam clamp. The fixture loads more rapidly and a heavier cut can be taken. We still run through some of the old-style roll stands, and one of them is shown in the illustration. The fixture is used for either style of stand.

Placing the Work Below the Cutter

The sixth, and last milling operation, is to finish the ear for the horn and the slot for the bearing. On the old design the ear only was finished and this was done on the string fixture used for milling the foot. The table was raised until the work was *above* the cutter. This was radically wrong as the tendency was to pull work, table, and saddle off their proper seats. The feed had to be very slow. In our new fixture the part is located by the foot and tail finishes and is clamped on the finished end of the slot. It is cam-operated, rigid and fast. The machine is a 48-in. Cincinnati automatic miller.

The top is next ground, as before mentioned, on a 14-in. Pratt & Whitney vertical grinder. Needless to say, this gives a superior finish in less time than filing. The grinder operator also takes care of the graduating while his machine is running.

The old milling machines were of the cone-driven type. The new ones are all high power Cincinnati millers and all are equipped with power rapid traverse.

The accompanying table shows the speeds and feeds used and total time per piece for each operation.

From the table, and considering a production of 20,000 pieces a year, the saving in wages alone can easily be figured. In addition it must be noted that we can produce in six months what we could not do before in a year and we have the machines available for other work. There are often cases where the saving would be as great but as the production is not as large they escape attention or are passed up because other work seems more pressing. It serves to show, however, what can be done by carefully going over and analyzing the work and the conditions under which it is done. Sometimes a new fixture will do the work. At other times it is necessary to replace an old machine with one designed for heavier cuts, to get the best results.

COMPARISON OF TIMES, OLD AND NEW EQUIPMENT

Old Tools				New Tools			
Operation	Cutting Speed, Ft.-Min.	Feed, In.-Min.	Total Time	Operation	Cutting Speed, Ft.-Min.	Feed, In.-Min.	Total Time
Mill top and graduate...	39	1½	7.7	Mill top.....	75	7½	2.85
Mill slot.....	60	16	3.96	Mill slot.....	60	6⅝	3
Mill foot.....	104	4	583	Mill foot.....	75	9½	2
Mill tail.....	125	6¼	1.65	Mill tail.....	75	6⅛	1.3
Mill ends of bronze bearing.....	220	4	3.77	Mill ends of slot for bearing....	75	9¾	0.9
Mill ear for horn.....	102	1.35	3.17	Mill ear and slot for bearing....	75	7¾	1.2
File top and slot.....	...	....	12	Grind top and graduate...	..	..	5
Grand total.....			38.08	Grand total.....			16.25

These articles won honorable mention

By J. E. Dykstra

Superintendent, Foos Gas Engine Co., Springfield, Ohio

THE purchase of new equipment is always a very simple matter in a plant where quantity production prevails. In cases of this sort it is only necessary to submit blueprints to a machine tool manufacturer and have him furnish guaranteed operating estimates. The saving to be obtained is readily calculated from a comparison with manufacturing cost prevailing with the old equipment, and it does not require a far sighted executive to determine whether or not a machine ought to be purchased.

In smaller shops where the production varies greatly in sizes and quantities and where a quantity of 50 pieces is an exception, it is much more difficult to determine the advisability of the purchase of new equipment. The case of which the writer speaks was one in which, it was felt in general, that the equipment was quite obsolete in the milling machine department, its best machine being a No. 3 machine of a certain well known make, more than 12 years old. A salesman was invited to come down with a representative of a milling machine company to point out the possible saving that might be effected with a modern machine tool, with the result that an armful of blueprints together with a letter stating the quantity of parts to be machined during the period of one year and a complete description of the fixtures available were sent to the milling machine company. It was agreed by all that on account of the cost of the available fixtures and the small quantities machined in a year's time, it would be impossible to replace the available fixtures, as the savings would not justify the cost. After a period of waiting, an inquiry to the agent brought the response that the matter had been dropped by the milling machine company, because the fixtures on hand would not be suitable to the capacity of the machine. The writer himself, however, was well convinced that a sufficient saving would justify the purchase of a new machine, but since the milling machine company despaired of figuring the saving possible, his position was somewhat difficult.

Not deterred, however, the purchasing department was instructed to comb the market for a used machine, and a No. 5 high-power machine, manufactured by the Cincinnati Milling Machine Co. three years previously, was located. This machine had been used very little, and was purchased at a very reasonable figure on the writer's recommendation that a net saving of $745 annually could be effected, after allowing 15 per cent for interest, taxes and depreciation.

As soon as the machine was installed, the cost department was instructed to make a weekly report on the savings effected by the machine. The results were so gratifying that a No. 4 machine of the same make was purchased inside of 18 months after the first machine was installed.

By H. K. Griggs

Foreman Machine Shop, The Portland Co., Portland, Me.

THE MOST striking example in my experience of saving by replacing old shop equipment was the scrapping of an old 96-in. lathe that had been blocked up to swing 11 ft., and installing a 12-ft. Betts vertical boring mill in its place.

One of the jobs frequently done on the lathe was boring and facing wood-chipper disks for pulp mills. The disks were made of steel and were 8 ft. in diameter and 3 in. thick, having a hub on one side.

A disk was bolted to the face plate of the lathe and the hole bored and the hub faced. It was then removed and put on an arbor, turned on the outside diameter and faced on the working side.

As the lathe was not stiff enough for heavy cuts and was further handicapped by being blocked up, it took a long time to do the work. The time for both operations was from 200 to 300 hours.

After the lathe work had been done, the disk was taken to a large planer, mounted on an angle plate and keyseated. This required from 25 to 30 hr. more.

The boring mill is equipped with a slotting attachment and the disks can now be turned, bored, faced and keyseated in one setting, a second setting being required for facing the hub. The time for all the work is from 60 to 80 hours.

Another job done on the old lathe was turning rails for rotary incinerators. These rails are the same as used on railroads, but are bent to a 10-ft. circle and turned on the outside. The lathe time was about 100 hr. but we now do them on the boring mill in as little as 3 hours.

On special jobs at day rates, an extra charge is made for the use of large tools and the boring mill earned 15 per cent of its cost in the first year on such charges alone.

I consider this boring mill a good investment.

Foreman Training

By Edward Bard

PRESENT DAY economic conditions have led many industrial plants to institute some form of training course for their foremen, and the efforts along these lines have met with remarkable success in some places, while in others the results have not been as good as were anticipated by the management.

As with any branch of educational endeavor, the real success of a foreman training course is measured by the practical use to which the information given is put. The acquisition of the subject matter of the course is not an end in itself, but is simply the opening gun in a campaign to increase the efficiency of the individual foreman and his ability to work in harmony with the rest of the organization.

In order to put precepts into practice, it is quite necessary to have clearly in mind what real groundwork has been placed, upon which to build. Such a study should not be tempered with too much enthusiasm. It is also to be remembered that little success can be expected if the foremen are left to put their new ideas into practice by themselves and in their own way.

What concrete things can, therefore, be expected from the foreman who has completed a course of study along the usual lines?

Benefits Derived from Training

First and foremost, a spirit of co-operation and a real desire to team up with the rest of the organization. This is a result not only from the teachings of the course, but also from the opportunities that have arisen to become better acquainted with the other foremen. Second, increased ability to look at a problem from more than one angle and, in many cases, a keen wish to look at it from the other fellow's side as a basis for better judgment. Third, a spirit of loyalty to the plant; but this depends wholly on conditions and, by no means, on the fact that he has been taught to be loyal in his course of study.

In addition to the above characteristics, the men will, of course, have a multitude of rather muddled ideas about how to handle various types of men, how to keep machinery operating efficiently, how to cut down waste, how to chart production and organization, and so forth. The main advantage from such teaching is simply mental development gained from thinking along these lines.

The Foremen's Club

In some plants foremen's clubs have been organized at the end of the study period, and these have functioned with success in some cases. One such club, organized without a well-defined program, started in to discuss plant problems of detailed character with the result that all advantages derived from the course, along the lines of co-operation and team work, were immediately lost through endless argument and bickerings among the various members. It is evident, from a study of various instances, that a club of this type should be kept as much as possible upon an educational plane, for it is a trait of human nature that we are most interested in those things from which we expect to derive some benefit.

Granting, then, that the foremen's club should simply supplement the educational work of the training course, we are still confronted with the problem of deriving the benefits for plant and men from the work that has been done.

A good way to conserve a spirit of co-operation is through proper organization. A proper organization outlines the responsibilities of each member and delegates authority in proportion. A loose organization, which permits shifting of responsibilitiy or overlapping authority, provides poor ground in which to sow the seed of co-operation. A foreman who knows his own authority and responsibility and also knows, or can find, the authority and responsibility of his colleagues, is in a good position to co-operate with them for the best interests of all concerned. In most cases the desire to team up with other departments is there. It is necessary only to show what is needed and how far he shall go before overstepping his own bounds. This seems to combat the oft-repeated statement that a man should lose no opportunity to be familiar with the whole plant and its workings, but such familiarity should not, by its own virtue, allow him to overstep his authority or shoulder responsibilities other than his own.

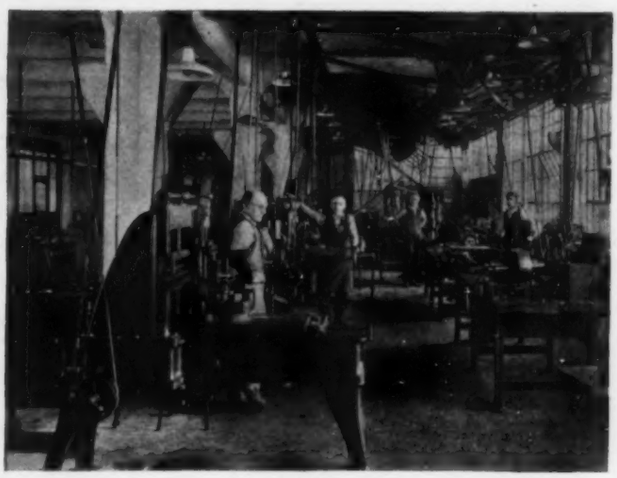
Broader Outlook and Judgment

The second characteristic, which may be expected in a foreman who has finished a training course, is a broader outlook on his own problems, and a greater ability to acquire a more seasoned judgment. This is a very valuable asset to any plant organization, not only in the matter of the duties that the foreman has, but in the development of better methods and practices. A man will begin to show marked individuality and originality as his viewpoint broadens and, if possible, he should be made to feel that his suggestions and criticisms are welcomed by the management. This is a difficult thing to do, as is shown by the ineffectual attempts of many managers to get suggestions from the men through suggestion boxes and other means. Instead of making the system for betterment ideas a grab-bag, into which the men are invited to throw anything, and from which the management hopes to draw something of value, the better way is to first outline betterments that are desired and then interview those whose advice is sought.

Loyalty in an organization is something which every industrial plant needs and which all managements desire. If the training course teaches a foreman that a certain principle governs a certain line of procedure, and he sees that principle violated continually in the plant in which he works, there is every reason to expect that his loyalty will waver and that the morale of the men under his direction will immediately suffer. The manager who considers a training course for his foremen should first be entirely sold on the proposition himself, and ready to apply the principles which are to be taught to them. Otherwise failure will most certainly result and conditions will be worse than before.

From the above considerations it would seem that the main advantages to be derived from foreman training courses are to be found in mental development, a better spirit of co-operation, a broader viewpoint and sounder judgment and, under proper conditions, an increase in loyalty and morale. A plant which undertakes foreman training with these expectations and with a desire to conserve those characteristics which result will almost surely meet with a considerable measure of success.

Assembly Bay, Grinder Department



Tool Room

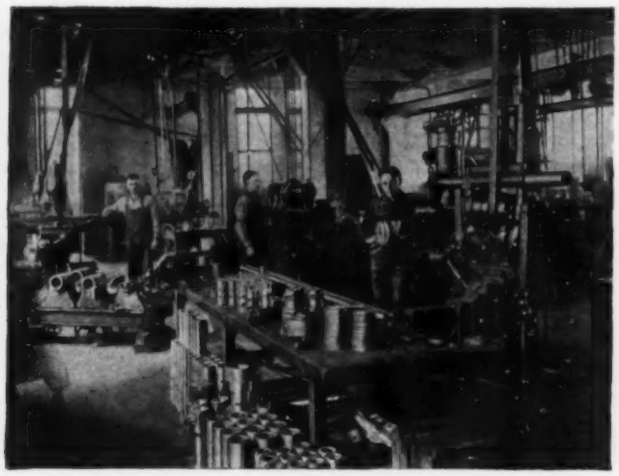
Where Machines and Tools Are Made

Charles H. Besly and Company

Founded 1875

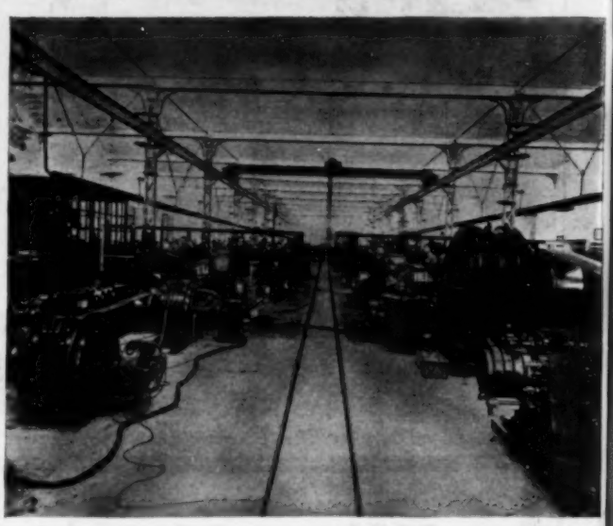
Battery of Thread Millers, Tap Shop

View in Grinder Department



Hardening Room, Tap Shop

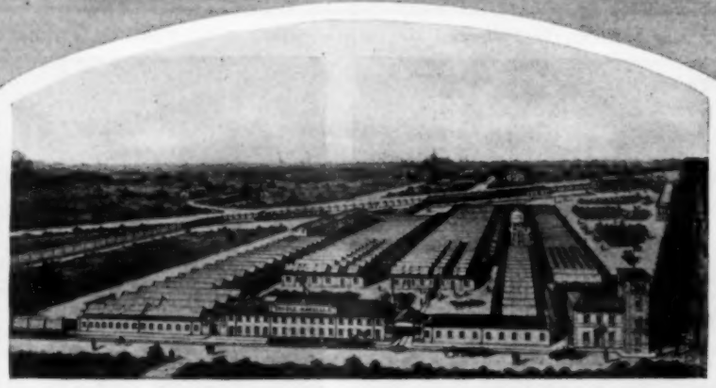
Flute Grinding Department, Tap Shop



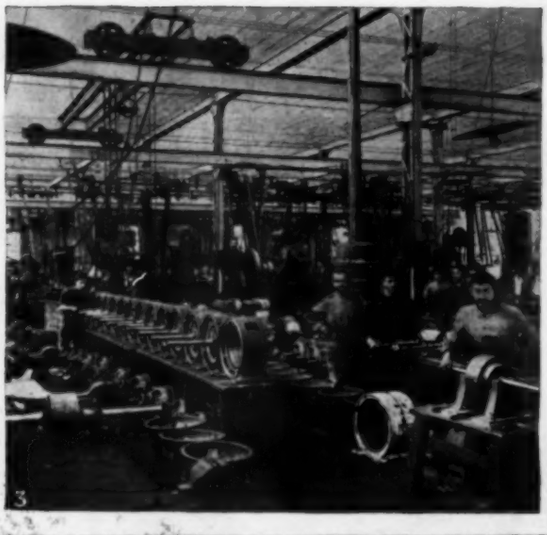
AN ITALIAN MACHINE PLANT

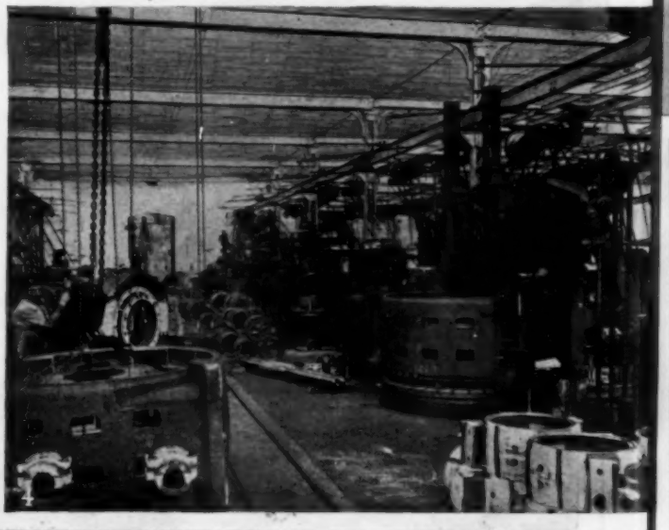
Ercole Marelli & C. Società Anonima Milan

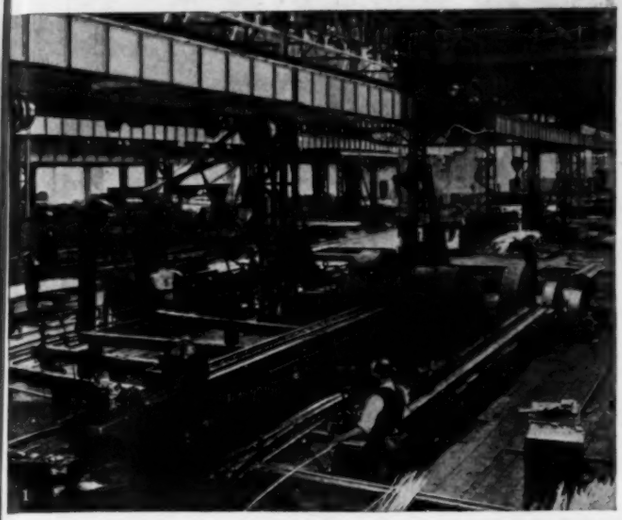
1
Fan Body
Division
2
Testing
Room



3
Motors up
to 100 hp.
4
100 hp to
1000 hp motors





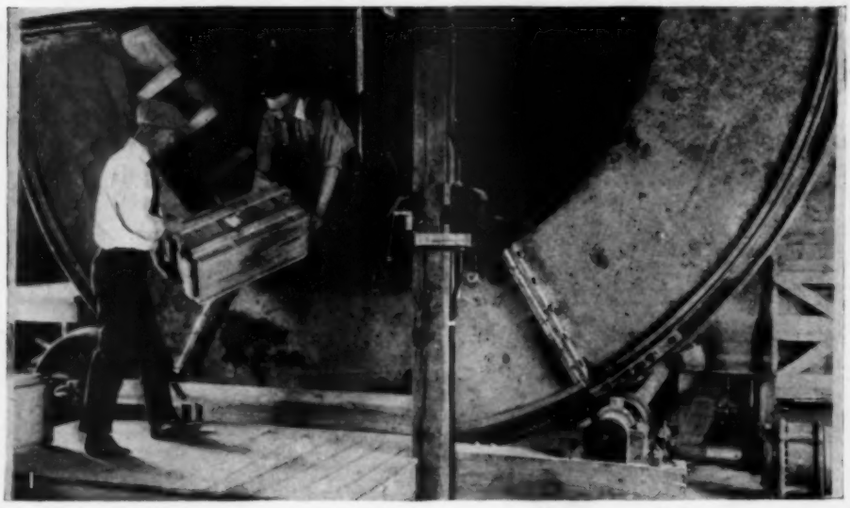


VIEWS IN AN AUSTRIAN STEEL MILL

Böhler Bros. & Co. Kapfenberg

1
Draw benches and straightening machines
2
The Steel Foundry

3
Crucible furnaces
4
Drop Forging Plant
5
Plate Mill



PACKING FOR SHIPMENT

(Photos from the Forest Products Laboratories, Madison, Wis.)

1

Revolving hexagonal 14-ft. drum used to test containers. It is lined with baffles, knobs and hazards to stimulate handling in transit

2

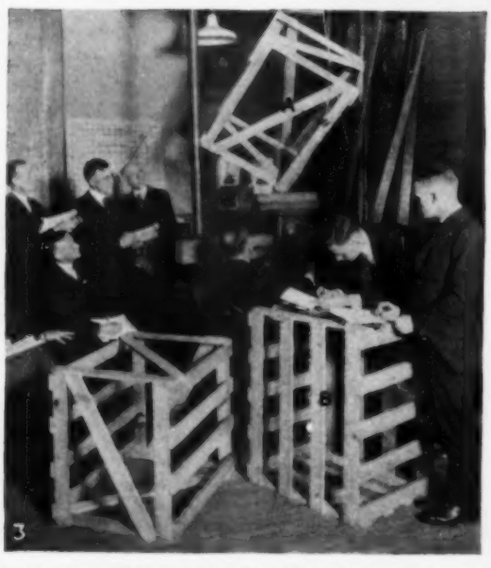
Two wire bound boxes after equal punishment in the drum. Box 1 made from ⅛-in., box 2, from ¼-in. material; nails and staples in box 1 at 4-in. intervals, nails in box 2, 3-in. apart, staples 2-in. apart

3

Crate "A" withstands double the diagonal compression that crate "B" will withstand. Bracing on crate "B" offers little resistance to weaving and skewing. Design in crate C useful only in packing contents which need protection on sides but are rigid enough to endure stresses diagonally

4

The fibre container with scores taped showed twice the durability of the one with scores unprotected



Building the Large Navy Dirigible ZR-1

BY F. E. SCHMIDT

An outline of the problem in designing and building the huge airship — Special machine for drilling holes spaced within two thousandths of an inch—Machining duralumin

IN UNDERTAKING to build its first rigid airship, the ZR-1, the U. S. Navy Department confronted a complex mass of new problems. They were essentially problems of structural design and fabrication, and were closely related to those which have been worked out by gradual practical development in the related field of steel structural work for building and bridge construction.

The ZR-1 is a huge structural framework of latticed struts braced by wire ties. Though precisely similar to any structural steel frame in its principles of arrangement, it is made radically different from such a frame by three characteristics: (1) The metal is duralumin, a light alloy of aluminum and copper; (2) the material is in sheet metal thicknesses; (3) the members, with few exceptions, are of triangular cross-section, so that the joints become special problems of great complication. The peculiarities of the duralumin, the problems of fabricating and assembling the sheet metal members, and the difficulties presented by the joints and of connections constituted the outstanding elements of the fabrication problem.

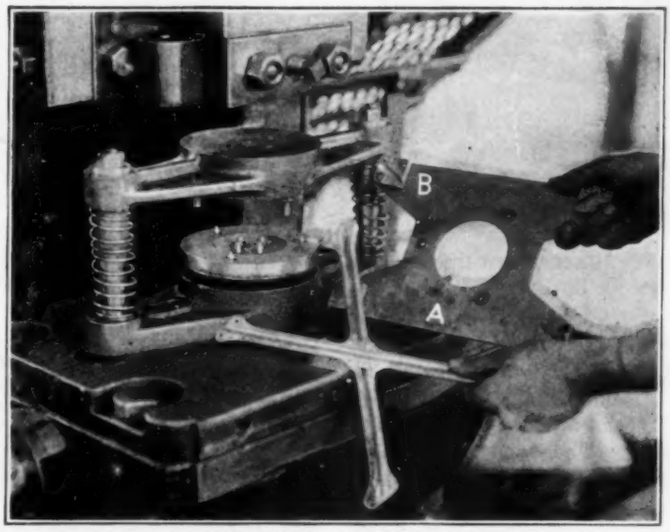


FIG. 1—DIE FOR ASSEMBLING STRUTS

For a general understanding of the construction problem it is necessary to outline a few essential facts concerning the structure of the ship and the material used. The frame of the ship, a cigar-shaped body of circular cross-sections, 680 ft. long and 79 ft. (24 m.) in diameter in the mid-section, is made up of frame rings spaced 32.8 ft. apart, connected by thirteen longitudinals and made rigid by diagonal wire bracing in the transverse planes of the frames and in the rectangular panels formed by frame members and longitudinals. Halfway between the main frames are intermediate frames, of lighter section and without transverse wire bracing; similarly, halfway between the main longitudinals are intermediate longitudinals, this secondary system being braced by a system of secondary wire diagonals in the outer surface. The entire hull frame weighs only about 15 tons; as there are about 3,000 struts in the frame, this is less than 10 lb. weight per average strut. Duralumin, the material used, has a specific gravity of 2.8 (slightly more than one-third that of steel), an ultimate strength of about 55,000 lb. per square inch and a minimum yield point of about 35,000 lb. The frame members are essentially struts or columns, and stiffness against buckling required that they be of large transverse dimensions and hence of very small metal thickness. For weight economy they were made of triangular cross-section.

Metallurgical difficulties in the production, rolling and handling of duralumin have been largely overcome. The metal may be annealed to a soft state by heating for one-half to one hour at 350 deg. C., and either quenching or slow cooling; or it may be brought to a tempered condition by heating to 490 deg. C. and cooling. Immediately after the tempering treatment it is soft, and remains so for one or two hours, slowly assuming the hard condition. The hard condition is wanted in the finished structural members, but work must be done in the soft condition. The processes of manufacture must therefore be arranged to utilize the short-time soft state immediately following the tempering treatment, unless later tempering is practicable.

Aside from the difficulties introduced by the nature of the material, there were perplexing difficulties of fabrication, chiefly due to the very light thicknesses of the shapes used. These may be readily appreciated by comparing with ordinary structural steel. As in any structural framework, it was vital that the individual members should be straight and that the structure should be assembled firmly and true to form, with bracing of uniform tension. Duralumin rolled channels of special section for the main members of the strut and stamped and punched lattice bars were furnished from the mill of the Aluminum Co. of America. The channels were in random lengths, to be cut to length at the factory as required. The lattice bars, cut and formed by die stamping from an annealed rolled strip and punched for the end and center connection rivets, were received ready for assembly.

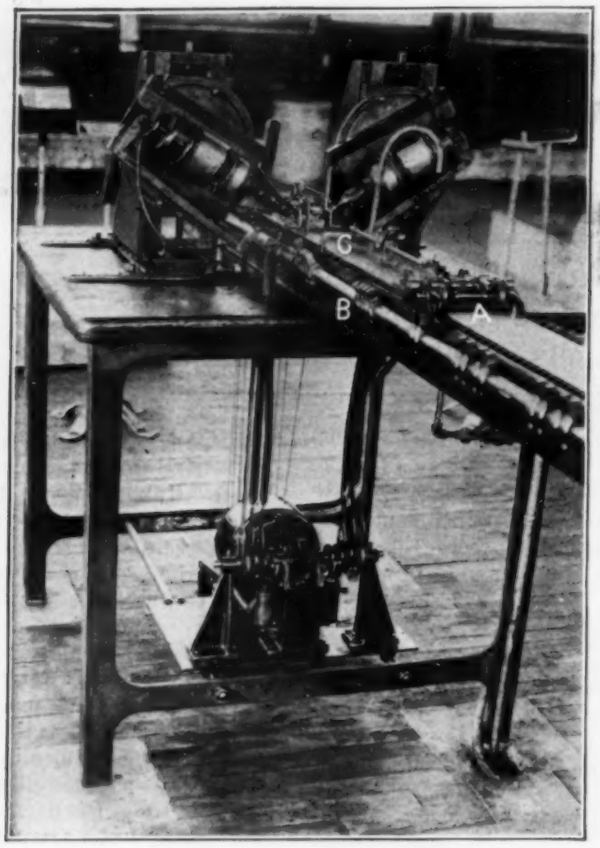


FIG. 2—SPECIAL MACHINE FOR DRILLING CHANNELS

Fabrication of the parts of the airship was allocated to the League Island Navy Yard, Philadelphia, and erection of the airship to the newly built naval air station at Lakehurst, N. J., where an airship shed 264x803 ft. was built three years ago for constructing and housing dirigible balloons. The work was put in charge of Commander R. D. Weyerbacher, U. S. N., who organized the fabrication at League Island and later took up the erection work at Lakehurst. In both parts of the work it was necessary to develop methods, tools and machines from the ground up, and work out in succession the problems met in the work. In spite of the assistance of English and German airship experts, the work remained essentially a pioneer undertaking.

The lattice bars were blanked from unannealed duralumin, varying in thickness from 0.015 to 0.026 in. After that they were heat treated and the ribs formed and pierced. For quick and accurate assembly of the struts the lattice bars were first riveted together in pairs to form crosses. The necessary high precision was obtained by use of a two-piece fixture shown in Fig. 1. A rectangular plate *A*, with corner dowels *B*, receives the two lattice bars and positions them. When laid over a central die plate having three dowels registering with holes in the rectangular plate, the four central rivet holes are brought directly over rivet dies on the die plate, and all four rivets are headed up in one stroke of the press in which the die plate is mounted. The punching of the lattice bars is initially checked up by their fit on the dowels of the frame plate; lack of distortion in riveting is checked by noting the absence of binding when the riveted cross is removed from and replaced on the plate.

FIG. 3—ASSEMBLING STRUT SECTION

The channels which form the longitudinal members of the struts are first cut to length by hand hack saws, allowing 2-in. over-run at each end. The rivet holes are then drilled in the automatic spacing machine shown in Fig. 2.

The triangular struts, which form the entire framework except for a few rectangular struts in minor positions, are of two shapes, equilateral and isosceles, the latter having a long side equal to twice the short side. Two forms of channel were provided, differing in the angle between the flanges. Both sections are 1.18 in. wide on the back and 0.459 in. wide on the flange, with the outer edge of the flange slightly turned in to stiffen it; they are 0.59 in. deep. Their thickness ranges from 0.031 to 0.079 in. The angle between flanges is 60 deg. for the channels used in the equilateral sections and the base channels of the isosceles section, and about 45 deg. for the channel used at the peak of the isosceles struts.

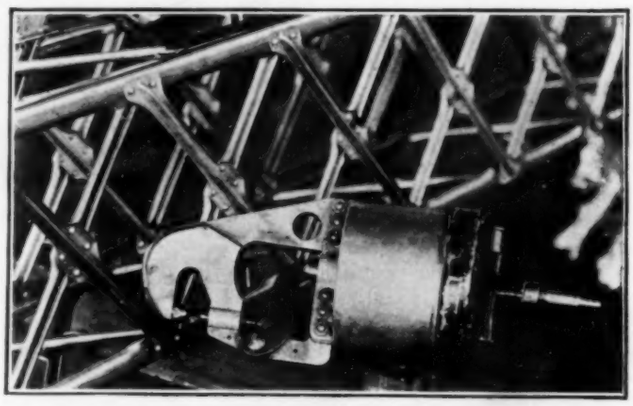


FIG. 4—RIVETER FOR STRUTS

In foreign practice, the struts have been built up complete in box-like forms, in which the channels and lattice bars were held firmly in position and then drilled and riveted in place. The builders of the ZR-1 decided upon pre-fabrication as being more rapid and accurate, believing that precision in locating the rivet holes would assure straightness and truth of the struts. Laying out and individual drilling of the holes were out of the question from this standpoint, and the development of an automatic mechanical spacing machine was undertaken, with entire success.

One end of the channel to be drilled is attached to a light carriage pulled along the table of this machine by a weight. Dogs along the sides of the table as at *B*, bring the carriage *A*, to a stop at the proper position

for the rivet hole. As the table strikes the dog, it trips a clutch which actuates a cam shaft (on a stand on the floor beneath the machine) by means of which four control motions are initiated in succession. The first presses a hold-down pad on the channel at the point of drilling, the second closes the drill circuit, the third feeds and returns the drill, and the fourth throws out the dog holding the carriage and sets the following one.

The channel slides over block *C*, which supports it while being drilled and the drill is guided by the bushing shown.

A high degree of precision is required in the work. An accumulated error of 0.006 in. on the 18-ft. length of a strut gives the finished strut a wind of ¾ in. in a 5-m. length. It was therefore considered necessary to limit the overall error in rivet holes in one channel to 0.002 in. To assure this degree of precision the stops

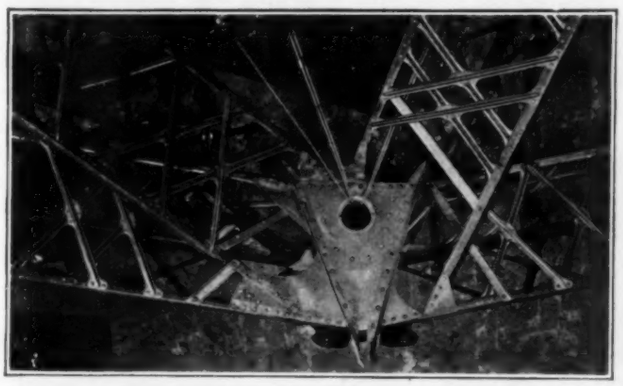


FIG. 5—WIRING AT MAIN FRAME JOINT

on the machine were set up by the use of fixed end-gages corresponding to the various rivet spacings required.

With the channels drilled thus accurately and the lattice crosses assembled precisely by help of the fixture previously described, it is possible to assemble a strut in the open and obtain entirely satisfactory results. Quicker work can be done, however, by assembling it in a form. Such forms, as shown in Fig. 3, have therefore been used for most of the work. Before the parts of the strut are placed in the form, the peak channel is clamped, back down, on a base strip and the lattices of both sides are bolted to it, with bolts in half the total number of holes; the bolts are set up tight by a screwdriver. Similarly the two base channels are bolted to the bottom lattice, on a flat support. The two parts then go into the form, where the strut is assembled peak down and clamped. The empty holes are riveted and then the bolts are successively replaced by rivets.

Rivets are driven cold. The air-operated toggle riveting press, Fig. 4, is also one of the tools designed for the job. It has a 3-in. air cylinder, and with 85 lb. air exerts a pressure of about 3,000 lb. It is necessary to adjust the grip of this press (gap at full stroke) to the grip of the rivet to be driven, as greater closure would be likely to deform or cut the metal of the channel; this adjustment is made by changing the dies, various dies of suitable length being provided. The strut shown in Fig. 4 happens to be of square section, though the main framing of the dirigible consists of triangular struts.

Doubled latticing (successive lattice crosses half spaced) is provided at the ends and load points of those struts which have to carry transverse load, as occurs in a number of members in the keel section, and also

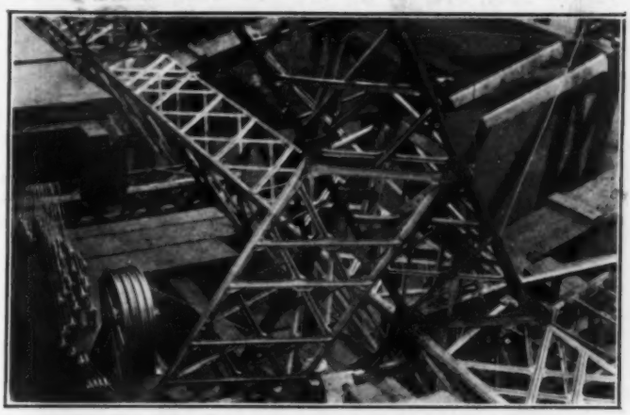


FIG. 6—FRAME JOINT AND CONTROL WIRES

in general where strength of joint is important. For the necessary inside attachment of the additional lattice members the in-turned edge of the channel flange must be straightened. This "lipping out" is done by a small press, or in individual cases by a hand tool shaped like broad flat-nosed pliers. Lipping out tends to curve a channel concave toward its inner edge, but the operator can neutralize this tendency by bending the channel out during the operation.

Three sizes of rivets are used in the structure, 0.0965 in. for the center connections of the lattice bars, 0.115 in. for the girder-lattice connections, and 0.154 in. for the joints. They are tempered before driving and must be driven within an hour following this treatment. In fabrication as well as erection the system was followed of collecting all undriven rivets at one-hour intervals and distributing freshly treated rivets.

Details of typical connections were worked out on the drawing board in the course of the original design, but much of the detailing was left to the shop, to be worked out in actual set-up. No attempt was made to develop templets or shape the connection parts from the drawings, but all these data were worked out by shop set-ups or, as they were called, "mockups." Where a large number of duplicate joints was involved, all or part of the mockup was built with waste members or ends of members, and the details worked out with them thereafter were used as templets for laying out the total number of connection pieces required. Where only one connection of a given kind was to be made, it was usually worked out on the members themselves.

How the Joints Were Fitted

If the complexity of the joints involved in the airship structure is considered, it may be realized that the detailing of the joints was a very tedious and extensive item of the whole work. A number of joints may be seen among Figs. 5, 6, 7 and 8.

A special method of working out the joints was applied to the circumferential frames, which constitute the major part of the ship framing. A large floor jig was built for fitting up these frames at League Island, as shown in Fig. 9.

A floor jig like that used at League Island but somewhat simpler in construction was built at Lakehurst for final assembly of the ring frames, as shown in Fig. 9. Here they were riveted and the diametral and chord wiring which holds the ring to shape was inserted and drawn up to proper tension. With some care in handling, the completed frame could be picked up without serious distortion and handled by hoist lines suspended

from the roof, over to the erection trestles, along one side of the big hangar, where it was set and blocked up, being lined up transversely and longitudinally by transit to true position.

The system of erection differed from that used in

FIG. 7—A JOINT IN "MOCKUP" ASSEMBLY

England, where it has been customary to set and brace permanently a pair of frames, then skip a panel and erect and brace the next pair of frames, later filling in the empty panels. For the Lakehurst work it was decided that continuous working would be better, starting from a rigid mid-section to be first set and braced. Accordingly the middle six frames were set, the longitudinals put in place, beginning at the bottom, first in the middle panel and then in the panels to either side, etc., and finally the wire bracing between frames and longitudinals was put in in similar sequence. In this process the farthest advanced portion, at the middle, was at all times more rigid than the portions to either side, and disturbance or distortion was minimized by carrying on the work symmetrically toward either end of the group of frames. It was thus possible without great difficulty to maintain the framework true and thus finally produce a mid-section fully braced and true to form, with uniform tensions in the bracing wires. In this initial operation only the main frames and longitudinals were placed, and the secondary system with its secondary bracing followed as a second operation.

Once the rigid central section was complete, work could progress toward either end independently without any tendency to distortion, greatly facilitating the work.

The wire bracing throughout the ship consists of hard-drawn steel wire from No. 9 to No. 11 wire gage, with No. 12 and No. 13 used in some minor services. Turnbuckles are not used, but instead the wire is drawn up and end loops formed and safe-ended, with the use of a tensioning device which permits the application of precisely the tension wanted. The tensioning device consists of a small winding frame comprising a cable drum or spindle attached to a gear, and a crank handle attached to a pinion meshing with the gear; a pawl on the housing of the device engages a ratchet wheel on the pinion shaft. A vise-like clamp is connected by a link to the winding-gear housing, and a similar one is attached to the outer end of a length of tiller rope which is wound on the drum of the winding gear. When a wire diagonal is to be put in, one end of the wire is passed through one of the eyes which it is to connect, a loop is bent, served with wire wrapping and soldered; then the other end of the wire is passed through its eye, and one of the clamps of the pulling device is attached to this free end, while the other clamp is attached to the standing part of the wire near the opposite eye. By

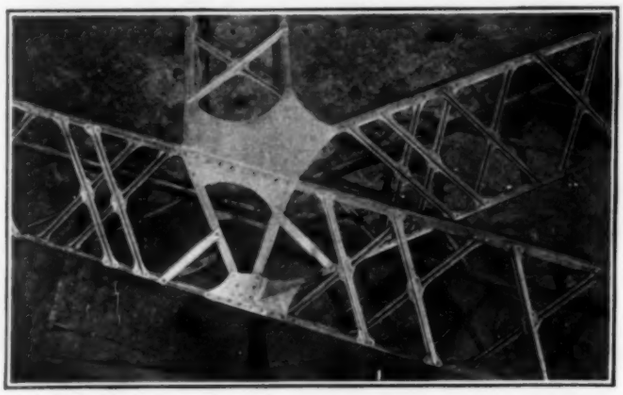


FIG. 8—FRAME JOINT WITH DOUBLE LATTICE

means of the ratchet gear the connecting rope is wound up on the drum and the free end of the wire thereby pulled up to any desired tension. The tension in the standing part of the wire is measured with a Larson wire-tension gage while the pulling goes on, and when

FIG. 9—ASSEMBLING A SMALL RING FRAME

it reaches 300-lb. tension, the desired amount in the diagonals of this airship, the free end of the wire is clamped to the standing part, served and soldered. The serving is done with No. 30 annealed steel wire, put on in about 100 turns with a small space left every fifth turn. Without releasing the clamp, the serving is then filled with a flux of stearic acid and resin, and soldered and wiped.

Gas Bags Have Automatic Valves

Each longitudinal element of the ship between main frames (10 m. long) is occupied by a separate gas bag. Each bag has a manually operated escape valve at the top and an automatic release valve at the bottom, vented upward through a tube passing through the bag. To resist the bulging tendency of the bags in the openings between the frame members, the entire inner surface of the frame is covered with a tightly stretched network of crossed diagonal wires (No. 13) spaced about 18 in., which are fastened to the inner channels of the longitudinals and ring frames. Inside of these is a smaller netting of knotted ramie cord about 9 in. mesh.

A skin of impregnated fabric covers the outside of the ship. It is put on in wide longitudinal strips, which are laced to the frame members around their edges. The spaces between the sections of fabric are covered with strips cemented on, and the entire skin is brush-coated with cellulose acetate.

The various problems encountered in the equipment of the ship cannot be gone into here. One of them may be noted, however, to illustrate the original experimentation required in their solution.

The aluminum gasoline distributing piping in the ship is connected by fittings of sand cast "lynite," an aluminum alloy. These fittings proved to be very porous; practically the entire lot leaked gasoline under a pressure test. The problem was to make them tight. Extensive experiments were carried out. Finally, success was attained by impregnating the castings with silicate of soda (water glass) under pressure. In the method finally used a lot of the castings are first subjected to a vacuum (25½ in. mercury was obtained), after which the water glass solution is admitted. The tank full of castings immersed in the solution is then subjected to a pressure of 300 lb. per square inch, which is left on for an hour. When taken out of the solution the castings are dried in the sun or at a gentle heat. The treatment makes them tight against gasoline in tests at 110 lb. pressure, which is several times as great as the highest service pressure.

Provision for Expansion

It may be added that expansion is provided for in the longitudinal piping as well as in the wire and wire-rope lines of the control system, which operates valves of gas bags, ballast tanks, and the like, engine telegraphs, rudders and other necessary controls throughout the ship from the control car under the forward portion of the keel. The expansion provision in the pipes consists of goosenecks, while the wire and cable lines have mechanical take-up, also operated from the control car.

The general design of the Fleet Airship ZR-1 was started under the direction of Commander J. C. Hunsaker, Construction Corps, U. S. Navy. The design of airships was under the cognizance of the Bureau of Construction and Repair. As chief of the bureau of construction and repair, Rear Admiral D. W. Taylor always displayed great interest in airships and due to his energy the work never lagged. Upon formation of the Bureau of Aeronautics, under Rear Admiral W. A. Moffett, the design of the ZR-1 was completed under the direction of Commander Hunsaker. The detailed design, fabrication of parts of the structure and power plant installation were performed at the Naval Aircraft Factory, Navy Yard, Philadelphia, Pa., under the direction of Commander G. C. Westervelt, Construction Corps, U. S. Navy, its manager. The development of plant facilities, methods and processes of erection and tests of the ZR-1 were performed under the direction of Commander R. D. Weyerbacher, Construction Corps, U. S. Navy, manager, Naval Air Station, Lakehurst, New Jersey.

Selling Machine Tools in Unusual Places —Discussion

By F. P. Terry
Belfast, Ireland

Happening to visit a little out-of-the-way town in northern Ireland, I dropped into a small machine shop to pass away the time, and I was forcibly reminded of the editorial on page 672, Vol. 58, of the *American Machinist*, under the title given above.

In this shop I found a collection of relics, consisting of old lathes (two with wooden beds), an old planer held together with many bolts and plates, and a sort of home-made shaping machine. In addition, there was one other machine, the pride of the old proprietor. There was not (according to the owner's opinion) anything like it within fifty miles. I had no difficulty in recognizing one of the most-up-to-date American lathes made by a firm advertising regularly in the *American Machinist*, and how it got there was the next thing that I wanted to know. The old fellow informed me quite seriously that his son got it for an "old song," in other words, next to nothing. This I found was practically true, the said son being an engineer in the British Navy during the war. One day his boat intercepted a ship load of these lathes and other machinery, destined for a port in Germany, which it never reached, being brought into a British port as a prize and the cargo sold. But from what I gathered from this old man of his son's wonderful cleverness as a sailor and engineer, I doubt very much if this lathe ever saw the sale and the mere song price was an exaggeration of the real paid price.

"It's a bonnie lathe and does wonderful good work, and is admired by everyone who sees it, and I could have sold it dozens of times, but it has one bad fault, there's plenty of change wheels but we can not cut a thread." Looking into the matter I found it was somewhat out of the ordinary, the wheels all being multiples of twelve up to ninety-six, consequently the old man's reckoning of five was all useless. With a little explanation from me as to how they do things in Germany and a sheet of paper, I was able to leave him a list of wheels necessary to cut most of the threads he would require, also full particulars of metric threads, which he was pleased to have.

He was more than pleased at the information I gave and I promised to send him—which I have done—a page from the *American Machinist* containing the maker's advertisement and the London agent's address

Liability of Buyer

When failure of buyer of machinery to give notice of defects may create liability for payment of price in full

By Leslie Childs

WHERE machinery is sold, under a contract that gives the buyer a certain time in which to test its sufficiency, it is usual to insert a stipulation which obligates such buyer to give notice of any defects within a named period. Stipulations of this kind vary in their terms, but, as they are inserted for the protection of the seller, they commonly recite that failure of the buyer to give notice of defects, within the time stipulated, will render the latter liable for the purchase price of the machinery in full.

Needless to say, under such a contract, the question of the liability of the buyer, in case he fails to give notice of defects within the time specified, becomes one of considerable importance. And, while this subject has been the starting point of much litigation, it cannot be answered by the statement of a hard and fast rule, for the reason that each case of this kind has necessarily been decided in the light of the particular facts involved.

However, generally speaking, a clear violation of a stipulation requiring notice of defects by the buyer within a certain time will render the latter liable for the price of the machinery. Especially is this true where by his silence and failure to give notice the buyer has prejudiced the rights of the seller to make good any defects that developed in the machinery on the trial. The application of this rule of law is illustrated in an interesting and instructive manner in the recent Washington case of the Gruendler Patent Crusher & Pulverizer Co., vs. the Preston Grain & Milling Co., 215 Pac. 60, which arose under the following facts.

A Case in Point

The defendant purchased certain machinery from the plaintiff under a written contract. This contract, among other things, provided for a test by the defendant, and notice within 30 days of any defect that might develop, and further that the failure of the defendant to give such notice should render it liable for the purchase price in full. That part of the contract dealing with this phase of the transaction providing as follows:

"By acceptance of this proposition you agree to install machinery and put same to work . . . immediately upon arrival of same, and if within 30 days after date of receiving machinery same does not come up to our representations, we reserve the right to have you notify us at once to send our engineer to investigate the trouble, to remedy same if possible. However, should the mill thereafter not come up to our guarantee, you to place the machinery on board cars f.o.b., your station, . . . and we will refund all money paid us.

"If your option to return above machinery is not availed of according to the above terms, and within the above 30 days, the machinery must be paid for in full. . . ."

The machinery in question was, it appears, delivered in February, 1921, and operated by the defendant from Feb. 8 until about March 19, during which time the defendant made no complaint of defects in the equipment. On the last-named date, however, the defendant notified the plaintiff by letter that the machinery was unsatisfactory, and pointed out certain defects and deficiencies.

Now, at this point, it may be noted that this letter was not written within the 30 days required by the contract for any notification of defects. The plaintiff appears to have ignored this letter; at any rate sometime thereafter the instant action was brought in an attempt by it to recover the purchase price of the machinery.

Upon the trial of the cause the trial court held that the notice of defects given by the defendant was too late, as it was not given within the 30 days stipulated in the contract, and rendered judgment in favor of the plaintiff for the value of the machinery. From this judgment the defendant prosecuted an appeal to the Supreme Court of Washington where in upholding this judgment it was, in part, said:

Defendant Held Liable for Purchase Price

"The parties here fixed their several rights and obligations by a written contract, which provided for a 30-day test in order to develop any inherent defects or want of capacity, with the right in the seller, if defects were developed, to send his engineer to investigate and remedy the same, and not having timely notice it was deprived of its right to remedy the want of capacity and other defects, if any, and by the terms of the contract the buyer became liable for the payment of the purchase price in full. . . .

"The theory of the trial court was the correct one. The evidence fully sustains its findings as to the failure to give notice within the time provided, and the judgment must be affirmed. . . ."

The foregoing case was well reasoned, and in view of the facts and the terms of the contract involved, it illustrates the application of the rule of law under discussion in an admirable manner. And too, while the case was of course decided in the light of these facts and the terms of the contract, the reasoning of the court is sound, is applied quite generally in situations of this kind, and is supported by much authority.

It is then obvious that, where machinery is purchased under a contract that provides for a trial and notice of any defects that may develop within a certain time, the giving of such notice, within the time named, may become of the greatest importance to the buyer. For, as in the case reviewed, if the buyer neglects to give the notice required within the time agreed upon, he may thereby waive valuable rights under the contract. Truly the point involved in the case reviewed is one of vital importance to buyers and sellers of machinery.

Position of the Machine Building Industry

By J. Bainter

It should be easy to be proud of membership in the machine building industry after reviewing even only slightly its history and noting its present scope. As for the history, articles now running in the *American Machinist* give some of the romance of the story. One needs but look about to observe the scope, as practically our entire civilization has been made possible by our machinery. Truly, we can consider ours the key industry.

The Elements of Production Grinding

BY ELLSWORTH SHELDON
New England Editor, *American Machinist*

The fifth article—Cause and remedy of chattering—Proper support of work is essential — The use of steadyrests — Importance of preparatory work

ONE OF the annoying difficulties most commonly experienced by the operators of grinding machines is that of "chattering," resulting in a rough corrugated appearance of the ground surface or in very fine parallel lines showing upon an otherwise smoothly finished part, according to the magnitude of the fault. It is almost certain to be due to vibration somewhere about the machine or work, and the cause is sometimes very difficult to trace.

Extreme cases of chattering, when the ridges left by the grinding wheel can easily be felt with the fingers, are not likely to occur, or, if they do, the cause may be quite obvious —as a wheel that is noticeably out of round, or a piece of work so springy that the vibrations may be seen. On the other hand, chattering is only too apt to appear when the operator is trying to secure an extra fine finish upon the surface of the work.

In the latter case the chattering appears as closely spaced, delicate lines of light and shade, very apparent to the eye because of the light refraction, but impossible to feel or to detect with measuring instruments. Unless the work in hand be of a very exacting nature, such chatter marks will do no harm, as the extreme height of the ridges—if they may be so called—is far less than the thickness of any oil film that would necessarily be interposed if the part were a journal.

Owing, probably, to the regular spacing of the marks it is a common fallacy to attribute them to the presence of toothed gearing somewhere about the machine, but that such a theory is untenable is amply proved by the fact that they are quite as likely to appear upon work ground in a machine that has no gears whatsoever in its construction as in a machine with a gear driven headstock.

Whatever the degree in which the chatter may appear, the operator will be safe in assuming that it is caused by vibration, and a careful search or process of elimination will, in nine cases out of ten, reveal the fault to be in the work itself rather than in the machine. Strange to say, a large and heavy piece of work is quite as likely to give trouble as a lighter and more springy piece, and the average operator will experience more difficulty in overcoming it for the reason that he does not suspect the true source.

No piece of work, however, heavy, is absolutely rigid. It will possess a "period of oscillation" governed by its size and weight, and may easily be caused to vibrate by any succession of small impulses that synchronize with it. Rhythmic vibration may also be caused by the steady but sustained impulse of the wheel in passing over the work, exactly as the string of a violin will vibrate in response to the bow.

When trouble is experienced from chatter, the first place to look for it is, therefore, in the work itself or in the manner of its support. If the machine be a cylindrical grinder, examine the condition of the head and footstock spindles to see that there is no looseness. See that the center points are true and of the correct angle, and that the center holes in the work are equally true and match the angle of the points.

Do not try to grind work of any length on the cylindrical grinder without intermediate supports, and do not be afraid to use too many steadyrests—it cannot be done. The proper distance apart to space steadyrests is determined by the room that the individual rest takes up; put them as close together as they will go.

Steadyrests are of various kinds and are of both the solid and the spring-supported type. Excellent results may be accomplished with either type when the principles upon which they are based are thoroughly understood. For comparatively light work which is subjected only to light cuts, the spring-supported rests are more convenient, as they will to a certain extent adapt themselves to the constantly lessening diameter of the work. On large pieces, especially under heavy cuts, the solid rests furnish a rigid support to resist the wheel pressure.

Several styles of rests are shown in Fig. 24. The one farthest from the observer in the cut is designed to inclose the work at some point that is not required to pass the wheel, as on long-shouldered shafts, where the rest acts as a bearing and causes adjacent parts to be ground concentric with the part supported by it.

The middle one shown in the cut is a solid rest with

ONE of the most frequently occurring and persistent troubles experienced by the operator of grinding machines is that of "chattering" of the work, resulting in a wavy appearance of the ground surface that is always objectionable to the eye and that may or may not be detrimental to the work, according to its magnitude and the service to which the ground part is to be put. Careful balancing and truing of wheels and the proper support of the work by means of steadyrests will generally reduce if not entirely eliminate the greater part of such trouble.

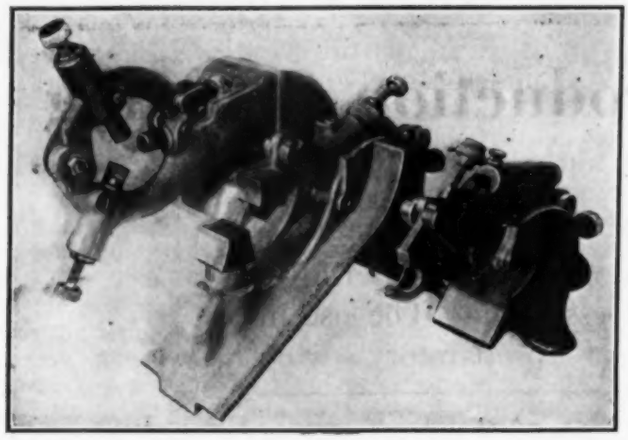


FIG. 24—DIFFERENT TYPES OF STEADYREST

adjusting screws conveniently located for the operator to follow the diminishing diameter of the work with either or both shoes and keep them at all times in contact. The third rest shown is of the spring-supported type and is designed to follow any irregularities of the work while at the same time supporting it against deflection.

The original conception of a steadyrest was that of a device for absorbing rather than preventing vibration and to a certain extent it had that effect, but the real office of a steadyrest is to *prevent* vibration by supporting the work so solidly that it cannot be made to vibrate. The absorption principle is most effective in the case of rhythmic vibration, where the work responds to the action of the wheel as a bell to the stroke of a hammer. Even the slight pressure of a spring finger will in some cases damp the vibration to an extent sufficient to eliminate the trouble.

The point in relation to the circumference of the

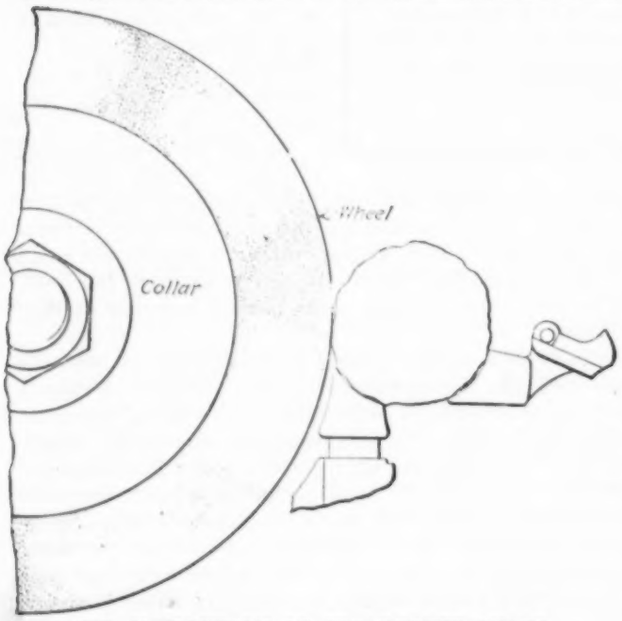


FIG. 25—POSITION OF STEADYREST SHOES

work and position of the wheel at which the shoes of a steadyrest should bear is of importance. A single shoe directly opposite the wheel will not prevent the work from vibrating—indeed, it will often aggravate it. The shoe should not be placed directly under the work.

Each rest should have two shoes bearing upon the work approximately 90 deg. apart. One shoe should be on the side of the work toward the wheel and well up to the point of contact between wheel and work. The other shoe should bear at a point about midway between the ends of the horizontal and vertical diameters. Fig. 25 is a diagrammatic representation of the position that should be occupied by the shoes. In this position any movement of the work due to its irregularity will be in a direction that does not seriously affect its diameter.

For a variety of work, when the number of pieces of a kind or diameter is small, the shoes may be of bronze or wood, but for long-continued service upon identical pieces, as is the usual condition in production grinding, the proper material to use for this purpose is hardened steel. Bronze or wood would not of itself abrade the work, but either material will soon become loaded with abrasive grains and will then act as a

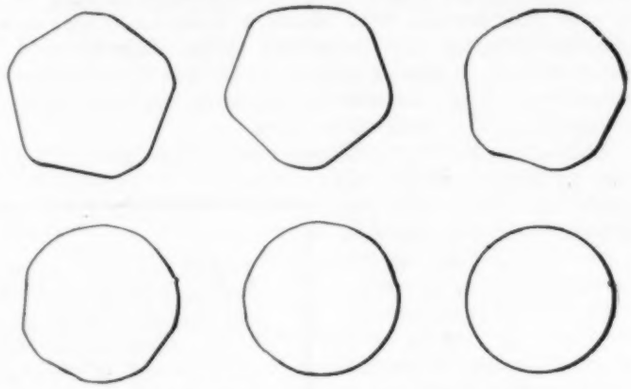


FIG. 26—A "SERIES OF PROGRESSIVE APPROXIMATIONS"

lap. The hardened steel shoes will not load and are not likely, therefore, to cause abrasion.

The shape of the steadyrest shoes where they bear upon the work is of importance; they should be ground to the exact radius of the finished piece they are to support. Before the grinding starts, the shoes will naturally bear upon the work at only two points (the ends of the included arcs) but as the diameter of the work decreases under the action of the grinding wheel the bearing will approach nearer and nearer to the full arc until, when the finish size is reached, the work will have a full and true bearing in each shoe.

The process of grinding a piece of work by the use of a steadyrest has aptly been called a "series of progressive approximations." Take, for instance, the grinding of a rough pentagonal bar as illustrated in Fig. 26 (which represents the result of an actual experiment conducted by a leading manufacturer of grinding machines and is not a hypothesis of the writer's) from approximately 2 in. to a truly round bar of $1\frac{3}{4}$ in. diameter.

Such a piece, supported by a rigid steadyrest and revolved before a grinding wheel, would at first have a very erratic movement because of the five "high spots" passing successively over the two-point bearing provided by the shoes. The bar rapidly changes its shape as it diminishes in size, the high spots changing position and appearing closer together as the work progresses, until the radius approaches that of the hardened-steel shoe of the steadyrest. By the time the radii of the work and shoe coincide, the former has

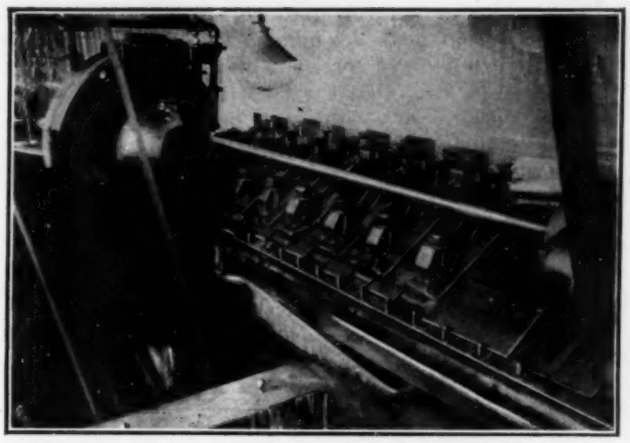


FIG. 27—A REGULAR PRODUCTION JOB

been reduced to a truly round bar of corresponding diameter.

The piece of work shown in the grinding machine in Fig. 27 is the lead screw of a well-known toolroom lathe and the job is one of regular production, 50 or 100 pieces being ground in a single lot. It will be noted here that the operator believes in the use of plenty of steadyrests and has placed them as closely together as they will go and still allow room for the water guards between them.

Though careful and considered application of steadyrests will almost always eliminate chatter that is caused by vibration of the work—and this, as has been said, is the principal cause—the rests cannot be expected to cure a disease that exists in some other part of the machine and after the operator has become convinced that neither the work itself nor its supports are at fault, it is time to look elsewhere for the cause of the trouble.

Next to springy and imperfectly supported work as

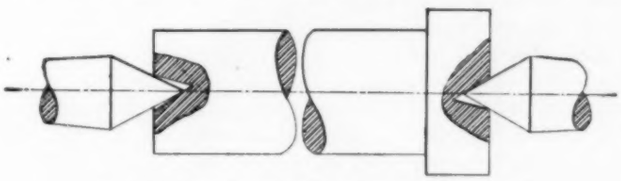


FIG. 28—CENTERS NOT IN ALIGNMENT

a cause of chatter, the greatest offender is probably an unbalanced wheel and it should be remembered that because it shows a proper condition of static balance while on the balancing ways, it does not follow that a wheel is not out of balance when it is running in the machine. There are other reasons for a lack of balance and the wheel itself may not be at fault.

Chattering *can* be caused by loose bearings on the wheel spindle, but while these bearings are often blamed, the fact is that they are about the least likely of any part of the machine to be the source of such trouble. If the bearings are loose they should certainly be adjusted to correct running conditions, but when once so adjusted and properly lubricated, further tightening will serve only to absorb unnecessary power, cause undue heating and perhaps destroy the bearings but it will never cure a case of chattering.

A spindle that is sprung will cause a true wheel to run out of balance and the operator of a grinding machine should make certain that this condition does not exist in his machine, by testing the spindle with an indicator. If the hole in the bushing is appreciably larger than the spindle upon which it goes, a true wheel may run out of balance because of being set eccentrically. If this is the case it should be packed true with paper or metal shims until it is concentric with the spindle. Truing it with a diamond while in the eccentric position will not help matters much, for the wheel will then have a heavy and a light side—it will no longer be a true wheel.

Chatter may be caused by a loose or improperly fitting wheel slide, and if a thorough examination into the above possible causes proves that the trouble is neither in the wheel nor its mounting, this bearing should be looked after. The wheel slide should move freely but without shake, and should always be kept well lubricated. If it is too tight it will move in a succession of minute steps instead of with a continuous movement, and it will be practically impossible to size the work with any degree of accuracy.

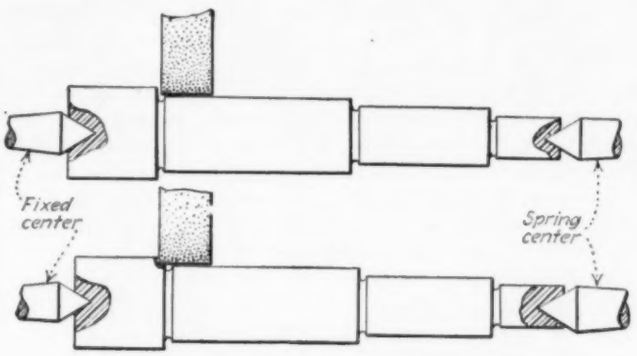


FIG. 29—CENTERS NOT THE SAME SIZE

Many little difficulties and annoyances are experienced in cylindrical grinding as a result of careless or imperfect preparation of the work. In such preparation at least one preliminary operation is necessary, whether any lathe work is to be done upon the piece or not, and that is the centering. If the pieces are rough turned upon the lathe it is not enough to assume that the centers upon which the work was turned are good enough for the finishing operations on the grinding machine.

The first requisite to good centers is a properly made center reamer. This tool must be true as to angle and with a correct amount of clearance upon each of its cutting lips, else the result will be an imperfect center hole. It is much easier with the average center reamer to make a hole that is not round than to make one that is and good grinding cannot be done when the work is supported upon centers that are not round.

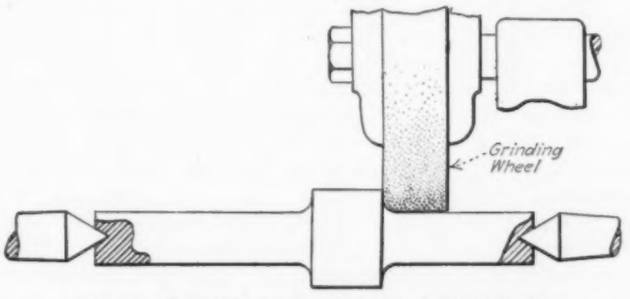


FIG. 30—GRINDING FILLETED SHOULDERS

Another thing that can cause a lot of trouble is to center the work upon a machine the spindles of which are not in line. This contingency is not likely to occur if a proper centering machine is used but, unfortunately, a great deal of centering is done upon sensitive drill presses, and with this equipment it is easier to make the center holes out of line than otherwise. Fig. 28 shows the effect of misaligned center holes when the work is on the center points of the grinding machine. A piece so supported will usually chatter badly in despite of perfect conditions in other respects.

Making the Work Round

Nor can a piece so supported be made round, parallel, or accurately to size without a deal of trouble. When several pieces of a lot are in this condition, especially if the degree of misalignment varies and the grinding machine warns its operator that something is wrong by refusing to size properly, the trouble is difficult to locate unless the operator has had previous similar experiences to direct his suspicion to the center holes.

Centered work that goes directly from the hardening department to the grinding room should have the center holes lapped true, both as to roundness and alignment. For this work the end of a three-cornered file and a piece of abrasive cloth is too often the only equipment, whereas properly formed laps and suitable abrasives should be used, and these only in a machine that will insure correct alignment.

It goes without saying that center holes should be deep enough, and, though there may be little likelihood of error in this respect, there is another consideration involved in the depth of the centers that is too often overlooked, and that is: the length of the pieces of any given lot should be alike when measured between the angular faces of the center holes, exactly as they *are* measured by the center points of the grinding machine. This point is of importance on any work and especially on shouldered work.

Further; if there *must* be variation in this respect, the variation should all be at the small end of the piece, for in nine cases out of ten the large end of the work is toward the fixed center of the work head of the grinding machine and a variation in depth of center hole at this end, as shown in Fig. 29, will cause a corresponding variation in the position of the shoulders with respect to the point of reversal at which the table of the machine is set.

Proper Location of Shoulders

In rough turning shouldered work, the lathe operator will invariably locate the shoulders from the small end of the work piece, and when, by reason of improperly made center holes, these shoulders do not all come the same distance from the large end, the grinding wheel is going to bang into the first "long" shoulder that comes along and there is bound to be fireworks, if not broken wheels.

If center holes are drilled with separate drill and reamer instead of a combination tool, make sure that the drill holes are deep enough. A small amount of time may be wasted in drilling them a little deeper than is necessary, but it is small indeed when compared with the time that will be wasted by the grinding-machine operator before he discovers that the trouble he is having in sizing his work is caused by the work revolving upon the point of the centers instead of upon their angular faces.

In roughing out shouldered work, ample clearances should be left, if possible, under each shoulder. Many grinding-machine operators believe that their machines will reverse to a line but they will not. On most small work a clearance of $\frac{1}{16}$ in. may be tolerated and the operator should never allow less than this amount of leeway when setting his machine. A clearance of $\frac{1}{8}$ in. is safer if the nature of the work will permit.

The operator of a grinding machine does not have much to say about the design of the pieces he grinds; he must take the work as he finds it. Nevertheless, in the interests of good design it should be said that generous fillets under the shoulders make for greater strength than undercuts. When grinding up to a filleted shoulder, as shown in Fig. 30, the corner of the wheel should be rounded to the same radius. In this case the table of the machine should be set to reverse while the wheel is at least $\frac{1}{4}$ in. away from the shoulder and upon the final cuts the table traversing should be done by means of the handwheel. The grinding wheel can then be made to finish the shoulder to any desired length.

Rough Turning Preparatory to Grinding

When rough-turning work that is to be finished to size in the grinding machine, every attention should be paid to the cutting lip of the lathe tool and none at all to the point upon which the "finish" usually depends. The tool should be calculated to get under and shear off the maximum chip at the highest rate of speed and feed that the machine and tool will permit. The rougher the finish left, to the better advantage will the grinding wheel remove the remaining stock.

The amount of metal left to be removed by the grinding wheel depends somewhat upon the size and nature of the work pieces. Long pieces with several shoulders should be left from $\frac{1}{32}$ to $\frac{1}{16}$ in. oversize because of the tendency of such pieces to "run out." For short pieces a grinding allowance of $\frac{1}{64}$ in. should be ample.

If the work is to be carbonized or hardened before grinding, the finish allowance must be kept as low as possible in order that the thickness of the carbonized shell may not be unduly reduced. An oversize from 0.008 to 0.010 in. is common practice, increasing or decreasing slightly in accordance with the nature of the work and its tendency to warp in hardening.

Effect of Cold-Rolling on the Hardness of Metals

The work to determine the effect of cold-rolling on the hardness of metals is being continued by the Bureau of Standards. The general character of the results obtained show that the change in hardness resulting from cold working is represented by the V-curve, the abscissas of which show the degree of cold working, and the ordinates, the softness of the metal. The only possible exception found so far is aluminum of very high purity. The results obtained for a specimen of this material indicated a progressive hardening upon increasing deformation.

Tin, on the other hand, gave the usual V-curve. Additional tests are being made with the "soft" metals, aluminum and tin, care being taken that the metals are tested immediately after rolling so that the chance for self-annealing is eliminated. It is also intended to make density determinations of several typical metals after various degrees of cold deformation.

Industrial Cost Accounting for Executives

BY PAUL M. ATKINS

Twenty-first article—Direct labor charge and hour methods of allocating burden — Determining the rate — The time element in burden application—Limitations of these methods

WE HAVE seen that the problem of apportioning the expenses incurred in the operation of a business to the product should be divided into two steps—the first of which consists of allocating to the several direct manufacturing departments the expenses of the other departments whose work has aided production, in proportion to the services rendered. In this way departmental burdens are built up which are summarized in a controlling manufacturing burden account. The second step is the one which is to be discussed in part in this article—the distribution of the burden to the product. In the preceding article it was also seen that not all of the burden should be assigned to the products but only that portion of it which measures the value of the service rendered to the goods in the course of their fabrication. Our present task, therefore, is to consider means by which the earned burden may be allocated in a satisfactory manner to the work as it progresses through the factory.

THE USE of direct wages as a means of apportioning the burden is correct in so far as the direct wages serve as a measure of time.

It is not satisfactory to apply the burden without taking into consideration the differences among the several departments in which it is incurred nor is it correct to apply all the burden, for the earned and unearned must be separated and only the earned apportioned to the work in process.

If conditions are such that it is appropriate to use the direct labor charges as a basis, there is no method which is simpler, easier or which requires less clerical labor for its operation.

There are a number of methods which may be utilized for the purpose and successfully used if the conditions are appropriate. In this article two variations of the same method will be discussed, and in the following article, two variations of another method will be investigated. The means of burden application which are here treated are probably the simplest, the most used and the most frequently condemned by progressive cost-accountants and hence it is worth while spending some little time finding out what is the real truth of the matter concerning them.

It may be said at the start that the way these methods are commonly used, a flat rate being developed without regard to departmental variations or fluctuations in the volume of business and hence of the incidence of the burden, cannot be too heartily condemned. There is no sound theory back of such procedure and in practice incorrect costs and misinformation can be the only result. In condemning these faults, writers on cost-accounting have been entirely correct. Unfortunately, they have not always perceived that many of the limitations might be avoided and that the advantages which the simplicity of such methods gives might well be retained.

The theory underlying the direct labor charge and hour methods of burden distribution is quite simple. A ratio is established in some way between the burden to be absorbed by the product and the amount of the direct labor hours. When the ratio has been established it can be applied to the various orders as they go through the department in proportion to the amount of direct labor charged to them or the number of hours which was worked upon them.

The first problem which we have to consider is the development of the ratio, assuming for the moment that the conditions are such as to make it possible to use these methods. After the departmental burden has been accumulated, the first step is to determine the number of hours or the amount of the direct labor charge which may be expected in the several departments if the volume of business is normal. The departmental burden is then divided by the labor charge or hours to find the rate, which is applied, as has been pointed out above, to the orders as they go through the department.

Essentially, what has been done is to determine a charge for the use of the services provided by the department; the longer the product enjoys such services, the greater must be the cost to it. At the same time, the rate at which the burden is allocated to the product does not vary with the volume of business, for the cost of the service rendered does not increase with the decrease in output.

It is important that the time element in burden application be kept constantly in mind for if it is not so held much of the significance of burden will be lost. It is only under exceptional circumstances that the time element does not have a part in the matter.

It is quite evident when it is remembered that expenses are almost invariably dependent on the time factor also and burden is simply expense looked at from another point of view. It may occur to some one

For the author's forthcoming book. All rights reserved.

to inquire how it is that wages can be used as a basis for burden application under such conditions. It is only because the time factor has played an important part in the determination of the wage charge that it can be employed for this purpose, and, as is seen later, under many conditions direct wages are not satisfactory because other factors enter in so extensively to the composition of the labor charge.

It should be quite clear that the development of a rate based simply on the total departmental burden for a period and the labor charge or number of hours worked in the department will not be correct for in this fashion the entire burden—unearned as well as earned—will be apportioned to the product and this, as we have already seen is incorrect. It is because of the custom of so doing that the method has not found favor among the cost-accountants who require accuracy in the records which they are keeping.

So far the assumption has been tacitly made that departmental burdens shall be built up before any effort is made to apportion the overhead to the product. It is true that such procedure should be followed but in the great majority of cases it is not, and hence we find ourselves confronted with another of the errors which have attached themselves to the method under consideration. It is common practice to establish a fixed rate to be applied either on the direct labor charge or hours, but without any regard to the variation of the incidence of the burden through the different direct manufacturing departments.

The establishment of a fixed rate approximates the idea of a normal burden rate, though rarely is any conception of the existence of normal burden rate or its meaning present in the mind of the man who sets the rate in this fashion. In so far, however, as the rate approaches a normal burden rate the development of the rate in this manner is correct. It is highly incorrect in disregarding the differences which exist among the several direct manufacturing departments, and so this reason is justly condemned as undesirable and misleading.

One Limitation on these Methods

If we consider simply the assembly department and the machine shop department of a metal working concern and the departmental expenses involved, it is evident that the rate of burden application is almost certainly different in the two. In the assembly department most of the work must necessarily be by hand, and little machinery will be employed. Hence there will be no large maintenance charges such as are necessary in the machine shop, no power costs and a much smaller expenditure for supplies. If the entire burden or expenses of the factory are to be lumped and spread by a flat rate over all the product without regard to the department in which the work is done, it is evident that the expenses of the above mentioned departments will become mixed and that if the rate is to be the same for both it will be too small in the machine shop and too large in the assembly department and incorrect costs are the inevitable result.

Of course, if the product is of only one variety and passes through the same processes in each department, then the final unit cost will be substantially correct. It must be remembered, however, that the departmental and process costs will be incorrect and under such circumstances, process costs are likely to be far more important to the management in the control of the business than are unit costs. If the company is turning out a variety of product then all the costs—aside from the direct costs—will be incorrect and the value of the cost accounts will be almost nil. In any event it is not worth while trying to apportion the burden and the time, and the labor employed in so doing is simply thrown away. It should be evident to any thinking person why the use of the method in such manner is condemned by all constructive cost-accountants.

It can easily be deduced from what has already been said that it is not worth while to apportion all the burden to the product regardless of the departments in which it is incurred by means of a rate on the direct labor charge or hours. To sum up then, we may say that it is not satisfactory to apply the burden without taking into consideration the differences among the several departments in which it is incurred, nor is it correct to apply all the departmental burden, for the earned and unearned must be separated and only the earned apportioned to the work in process. It is only when departmental burden rates are worked out in the way which was described some paragraphs above that the percentage on direct labor charges or hours can be properly used.

Limitations Within a Department

Our analysis of the problem is not yet ended, however, for further investigation shows that there are still other limitations on the use of the method. We have already seen that consideration must be given to the differences which exist among departments and have used the illustration of the assembly and machine shop departments. It must not be forgotten that the incidence of the burden varies within departments also. It must always be kept in mind that in the application of burden to the product the effort should be made to allocate it in proportion to the services rendered so far as that is possible.

Let us consider the machine shop department a little more in detail and see how the problem presents itself there. Having ascertained the normal departmental burden and the normal number of direct labor hours or total direct payroll, it would be quite easy to fix a burden rate. But would the rate so found by simple division be a correct one in the light of what has just been said about services rendered? Should the same rate be charged for an hour's service of a large size planer as for a small size drill press? Obviously the cost for the service is not the same. The planer, for example, may use more power in an hour than the drill press does in a week; it probably occupies ten times as much floor space; the depreciation taxes and insurance on it all are far larger than on the drill press; and without much question the cost of its maintenance is much more.

If a flat rate per hour is set, however, part of the cost of operation of the planer will find its way against the product which is being worked on at the drill press, since the burden is being considered departmentally and not from the point of view of the machine or production center. It is obvious, therefore, that where there are marked differences among the costs of operating the several production centers of a department this method of burden application is not satisfactory even though all the other requirements are met.

In such a department as the assembly department, on the other hand, where the only equipment consists of benches all nearly alike, and where any differences are not such as are likely to cause any variation in cost of

operation, this method is most acceptable and gives very satisfactory results. It is not at all necessary that there shall be no machinery in the department or that it shall be all alike from the mechanical point of view; it is only essential that the cost of their operation shall be the same.

Limitations of Direct Wages Basis

It is now time, perhaps, to consider certain limitations which affect the development of a rate on a basis of the direct labor charges. The use of the direct wages as a means for the apportioning of the burden is correct only in so far as the direct wages serve as a measure of time, since burden depends directly on time. Hence whenever wages are paid on a piece rate basis the direct labor charges are useless as a means of distributing the earned burden since they do not represent fundamentally a measure of time.

Variations in the wage rates within a department are another limitation on the use of this basis. It often happens that the man who is paid a high rate does only bench-work, hand-fitting, or repair work, which requires little use of machinery, while a man who receives a much lower rate may be engaged in running a large turret lathe whose expense of operation is considerable. When such conditions as these exist it is evident that the direct wages will not serve satisfactorily as a measure of time, and hence as a means of apportioning the earned burden. It becomes necessary, therefore, whenever there is a marked difference in the wages paid the workers to use the direct labor hours instead of the charges.

In the illustration used above, of course, neither basis would be correct because of the variation in the cost of operating the two production centers. It not infrequently happens in an assembly department, however, that there is a wide variation in wage scale—some of the jobs requiring much more skill than others, and some workers having been on the payroll much longer than others—yet the actual burden per hour is about the same for all. If anything, the lower paid workers receive more supervision and their work has to be more carefully inspected than is the case for the more highly paid and presumably more skilful workers, but if the burden is allocated on the basis of wages, the work which should receive the smaller share of the burden actually receives the greater.

The Advantages

It might appear from all which has been said about the many and varied limitations on this method of burden application that it would probably have few advantages and be seldom usable. It does have certain very distinct good points, however, which deserve mention. If conditions are such that it is appropriate to use the direct labor charges as a basis, there is no method which is simpler, easier, or which requires less clerical labor for its operation. It is almost without exception necessary to accumulate the direct labor charges against the several orders or processes, and when this has been done, the application of the burden is the work of but a moment. If it is possible to use the direct labor charges, it is usually very simple to collect the direct labor hours, and though a little additional work is needed in the cost department for this, it is not usually a serious burden and except for this added detail the method is as simple as before and often distinctly more accurate.

It is not at all necessary that the same method be used for the application of burden in all departments and so it frequently happens that in one or more of the direct manufacturing departments it is possible to use either the direct labor hour or charge method and so obtain the benefits of its simplicity even though it may be essential to employ a complicated means of allocating the burden in other departments. It often happens that this method in one or the other of its principal variations can be applied rightly where some modification of the general plan is now utilized wrongly if only the fundamentals of sound burden application are kept clearly in mind.

The details of the practical use of the method are simple. The number of hours worked or the total of the direct wages in each department in which work is done on an order are summarized from the time tickets. The totals are then entered on the order cost card, extended by the appropriate rate, and the result also entered on the card. The entry represents the earned burden for the order.

Controlling Account Entries

The controlling account entries are equally simple. If a percentage on direct labor cost is used, the total direct wages in each department can be obtained from the payroll summary. The direct wages multiplied by the departmental rate gives the earned burden for the department. The total of the departmental earned burden gives the total earned which should be prepared as a general journal entry—a credit to the manufacturing burden account and a debit to the several "in process" accounts.

If a rate per hour is employed it is well to arrange the payroll book in such a way that the total direct hours worked in the several departments can be obtained therefrom. From this point much the same procedure as that just described should be followed.

The sum of the earned burden charges to the several orders for the month in question should, of course, agree with the controlling account entries prepared in some such fashion as that just described. If a reconciliation cannot be made to within less than one per cent of the total involved, all the entries should be checked to find the error.

Within their limitations the direct labor charge and hour methods of burden allocation are very useful means of dealing with the problem involved. It must always be remembered that they have limits and that when complex situations are met, more highly developed means of dealing with the question must be used. One of these more complex methods is the subject of the next article.

Cast Iron for Enameling Purposes

The Bureau of Standards has received a number of specimens of typical enameling castings, and these are now being enameled with several commercial cast iron enamels. The chemical analysis of the castings has been made, and the Bureau also plans to make up typical bodies of cast iron in its metallurgical division. The specimens thus obtained will also be analyzed chemically and enameled. An attempt will be made to correlate the blistering of the enamel and the chemical composition of the cast iron, with the object of obtaining a good commercial cast iron which will not produce blisters.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

A Quick Method of Pointing Pins—Discussion

BY GEORGE R. BOTT

On page 149, Vol. 59, of the *American Machinist*, there was published an article under the above title by R. H. Kasper. Mr. Kasper's method is all right on small stock but would be very slow on stock of one-half inch or larger.

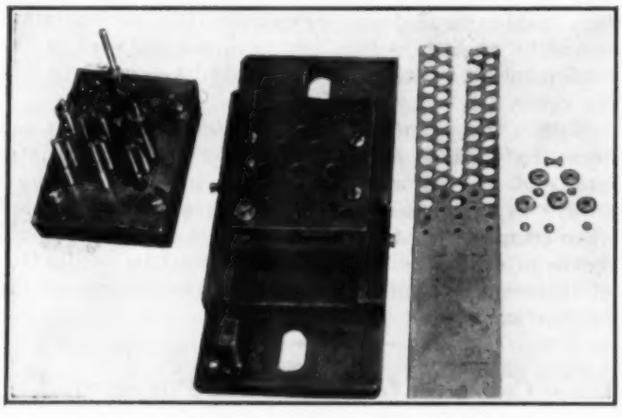
A few years ago while working where a cofferdam was being built, an order came to the shop for 3,000 drift pins, 12 in. long, to be made of ¾-in. round stock and pointed at one end. This job was accomplished in four days of eight hours each by means of a bolt-threading machine. A worn-out set of dies was ground to the required angle of the point, placed in the die-head and closed until they were tight together. The stock was then fed into these dies at high speed, using lard oil. A sharp, smooth and concentric point resulted from this method.

A Set of Washer Tools

BY WILLIAM DENTON

The illustration shows a set of washer tools for making the small embossed washers of fiber, used in large quantities for insulating purposes in the manufacture of electrical devices. Five washers are made at each stroke of the press after the fourth, and the scrap is cut in two strips.

On the first stroke of the press three holes are pierced



PROGRESSIVE WASHER TOOLS

in the stock. On the second stroke the embossing, in the form of a depression around the holes, is done. The third stroke cuts out three washers and pierces two more holes. The fourth stroke embosses the two holes last pierced, and upon the fifth stroke the tools are in full action.

The final punch with the long pilot comes into action on the sixth stroke and divides the strip of scrap into two parts. This punch is round only for convenience in making it. The shape of the piece it cuts out may be seen to the right, and is scrap. The long pilot is the stop against which the strip is located at each movement of the stock. A progressive stop, the position of which is changed at each stroke, may be seen at the left of the die. Its duty is to locate the strip for the first four positions, after which it is drawn out and laid aside.

Saving Money on Piston Rods and Packing

BY I. B. RICH

A piston rod isn't very different from any other shaft of the same size and length except for the fit in the piston and in the crosshead. And the method of fitting has changed very little in the past 50 years. For the most part we still cut a big slot through the tapered end of the rod and drive a taper key through it, to hold it in the crosshead. Why more of them don't break through the slot is a mystery to me.

The turning and finishing of the rod has seen some changes from the days when we had wrought iron rods with more or less seams running lengthwise. Then we turned them as best we could, at about 20 ft. a minute, and filed them smooth in the lathe. Sometimes we polished them with emery-cloth. In the days of low steam pressure and hemp packing, it didn't make so much difference as to the rods being either round or of uniform diameter. But the metallic packing made us pay more attention to the rod work. I have seen new engines come on the road with the piston rods turned so roughly that we used to call them "rat tail files for wearing out the packing."

Then we began to pay more attention to getting the rods round and smooth. We learned that filing in a lathe never made anything round, so we stuck to turning them as smoothly as we could. Then some bright individual began to finish piston rods and a lot of other work with a roller tool and we all followed suit. Most of us are still doing it.

A few shops have a grinding machine which will swing a piston and piston rod but these shops are few and far between. Some shops have attempted piston rod grinding with a heavy tool post grinder, but this is a makeshift and production cannot be gotten in this way.

With a piston rod grinding machine and some one with the nerve to set a few standards for "undersizes," just as the automobile men do for oversizes of pistons and piston pins, a lot of money could be saved in a big shop. By having a few standard sizes to grind piston rods down to, the metallic packing could be cast in a metal mold to these sizes and used without machining of any kind, or it could be finished with a reamer if desired. There would be no boring to fit, as at present. This is one of the many ways in which railroads could save money on repair work.

Designing and Cutting Sawtooth Clutches

By Archie C. Smith

The writer had occasion to make use of several quick-acting clutches and, as the quickest acting and most positive is the "sawtooth" variety, this form was selected.

The handbooks present a formula for the cutting of such clutches based on the angle of the milling cutter

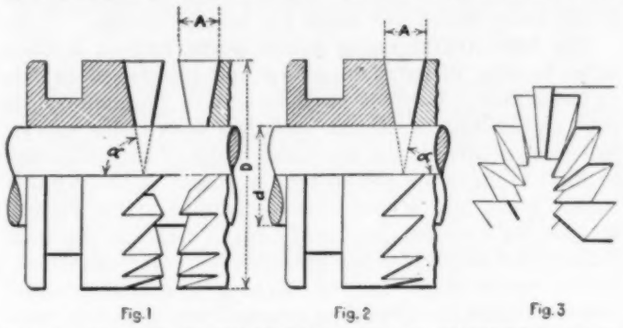


FIG. 1—CLUTCH WITH TEETH CUT BY HANDBOOK FORMULA (TEETH DISENGAGED). FIG. 2—SAME CLUTCH WITH TEETH ENGAGED. FIG. 3—APPEARANCE OF TEETH CUT BY HANDBOOK FORMULA

used and the number of teeth to be cut. While the teeth of clutch members cut according to the formula given will mesh perfectly, they are not as strong as they might be made.

This condition will be appreciated upon an inspection of Fig. 1 in which the two members of a sawtooth clutch are shown separated. Fig. 2 shows the same members engaged. It will be noted that while they fit perfectly when in mesh, the action at the commencement of engagement or when the teeth just touch, is anything but ideal. This action becomes worse as the speed is increased.

The formula presented in the handbooks for obtaining the angle for setting the index head of the milling machine to cut the teeth is as follows:

$$\text{cosin } a = \frac{\sin\left(\frac{360}{N}\right) \times \text{cotan of cutter angle}}{1 + \text{cosin}\left(\frac{360}{N}\right)}$$

From which A, Figs. 1 and 2, $= D$ cotan a

a is the angle for setting up the milling machine, N

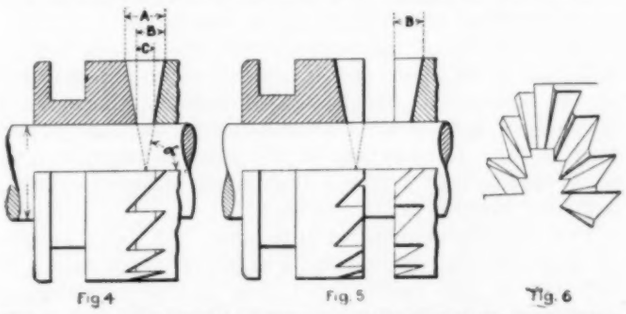


FIG. 4—CLUTCH WITH TEETH CUT BY MODIFIED FORMULA (TEETH ENGAGED). FIG. 5—SAME CLUTCH WITH TEETH DISENGAGED. FIG. 6—APPEARANCE OF TEETH CUT BY MODIFIED FORMULA

the number of teeth to be cut, A the depth of cut at the outside and D the diameter of the blank.

The appearance of the finished teeth will be as shown in Fig. 3.

An improvement over this method and one which the writer has found to eliminate the faults of the above formula is shown in Fig. 4. An inspection of this sketch will show that instead of engagement being effected by a series of delicate points clashing together there is, on the contrary, a line contact, the length of which equals the length of the teeth.

In selecting suitable proportions for the teeth it is necessary, first, to decide upon their number and the angle made with the shaft centerline, and then to obtain angle a by the handbook formula. Distance C is dependent upon the depth at the bore and equals d cotan a and is the amount of overlap of the teeth.

$B = \frac{A + C}{2}$ and is the depth of cut at the outside.

Fig. 5 shows the members out of engagement.

The appearance of the finished teeth will be as in Fig. 6. It will be at once apparent that the top faces of the teeth will not be cut away but will remain at right angles with the shaft. This construction produces a flat topped tooth which does not detract in any way from an instant engagement but on the other hand has the advantage of great strength.

Scaffolding for Use in Erecting Machinery

By L. M. Francis

The illustration shows a very convenient and substantial scaffolding for use around the shop where locomotives or other large machines are to be erected, or

SHOP HORSES MADE OF IRON PIPE

for overhead work. The standards are light, take up less room than the usual wooden horses and have a greater range of usefulness.

The standards are made of wrought-iron pipe of 2 in. or 2½ in. diameter, and the bases of structural-steel angles. Holes are drilled through the pipes at intervals of about 12 in. and through these holes are passed 1-in. round bars, threaded at both ends and with two nuts at each end, one inside and one outside the uprights.

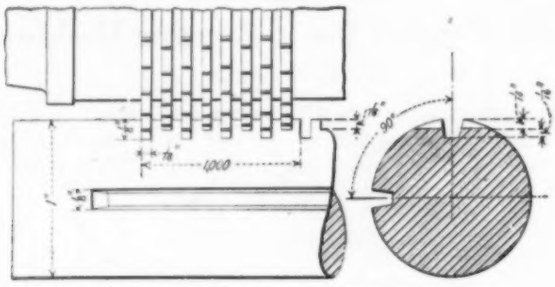
Suitable planks laid across the horizontal bars make a convenient platform at whatever height may be desired.

Unusual Methods of Making Graduated Rods

By Donald A. Hampson

A New England shop manufactures a special machine on which is used a 1-in. rod graduated for 84 in. and a similar rod graduated for 66 in. The graduations are made by milling cutters $\frac{1}{16}$ in. wide that cut across the high part of the round and the rods are further machined by cutting two keyways that run the full length. This statement immediately pictures to mechanical men the crooked shapes assumed by the rods and the long, uncertain job of straightening them.

Having been through the usual experimental processes and settled on a method that appears extremely simple, judging by the ease with which the men turn out the parts, the process will be of interest to others who have to straighten bowed shafts to a nice degree of accuracy. In use, the rods are traversed by light iron castings having spring-actuated index, or locating blades that engage the slots milled across the rods. The slots serve both as visible indicators and as accurate spacers for



UNUSUAL GRADUATING METHOD

the castings, which are really movable gages. A total error of $\frac{1}{16}$ in. in the length of the rods is permissable.

Figures are stamped on the rods at every inch and the milled slots are made $\frac{1}{8}$ in. deep for the quarters and $\frac{1}{16}$ for the eighths, measured at the high part of the rod.

A gang of cutters is used that will mill one inch at a time and the work is done with a rack-cutting attachment on a No. 2 Kempsmith milling machine. After each inch is cut, the table is moved 1.000 in. by the dial on the hand-feed screw. For some time the shop used a pilot piece and checked each setting with a special gage, but it was discovered that graduations fully as accurate could be made by depending upon the dial alone—and at considerable saving in time. Some of the machines are exported to France and for the rods used in them, a gang of cutters is provided that will produce graduations to suit French measurements.

The rods are graduated for a length of about 2 ft. by table movements of 1 in. Then the table is run back, the work unclamped and moved along, and the cutters lined up with the cut previously made, before proceeding again.

The two keyways are V-shaped, $\frac{1}{8}$ in. wide at the top. One of them runs through the center of the graduated part and the other one is quartered. The keyways are cut before the graduations.

A cast-iron fixture is used on the milling machine, the same one answering for both the graduating cuts and the ones for the keyways. The fixture encircles three-fourths of the rod—the top being the open part—and clamps the rod by having one side a loose piece.

The cuts are localized on less than one-third of the rod's surface and the total bow from the cuts amounts to an inch, but the rod never shows that much, as straightening operations are performed between cuts. Selected stock is used but even that has to be gone over and some straightening done. After cutting the keyways, the rods go through another straightening, which must remove a nearly uniform bend from the entire length. And following the graduating, the third and most particular straightening takes place. The bend this time is in nearly the same place as before but does not run clear to the ends, which are blank for several inches.

The first straightening job is performed in a 16-in. lathe having an extra long bed and purchased to take in these rods. Centers must be put in the ends of the rods and shoulders turned, so it has been found quicker to look over the blanks for kinks while in the lathe than to shift them to the straightening press. A short bar of square steel, laid across a piece clamped in the toolpost and having a copper protected end, is used for the work. Subsequent straightening operations are performed on a Geier screw-press having sliding centers attached. These centers are placed so conveniently that the workman does not have to move away from his position during the entire straightening. The open front, screw type of press is especially handy and adapted to this class of work. By means of a dial, the amount of pressure applied each time may be noted, which is a great aid when more pressure must be applied in the same spot or when the pressure has bent the rod too much.

In straightening cold-drawn and other finished pieces, the surface is too often badly bruised and these rods must be turned out without any evidence of mishandling, even though they get severe treatment in the straightening. To cushion the ram, a steel sleeve 2 in. long and bell mounted at both ends is slipped over the rod to serve as a pressing piece. By use of this sleeve and fiber lining in the V-blocks, no injury results.

Automobile Piston Clearances—Discussion

By James McIntosh

I had not intended to notice the letter on Automobile Piston Clearances by D. P. Muirhead, published on page 344, Vol. 58, of the *American Machinist*, for the reason that such figures as he gives are of no value in that they fail to account for so many factors entering into the problem of controlling piston conditions.

The capacity of the cylinder walls to absorb heat is a factor, as is also (and to even greater extent) that of the piston, and the design of both is, therefore, a controlling influence. Compression is also an important factor. Lubrication by the splash system will, to some extent, cool a piston that might otherwise retain sufficient heat to cause trouble.

Otto M. Burkhardt, writing upon the same subject on page 65, Vol. 59, refers to a piston temperature of 800 deg. F. and assumes a piston of that temperature operating in a cylinder, the walls of which are but 200 deg. F., with ring temperatures of 500, 400 and 300 deg. F. respectively. These figures indicate a rate of heat absorption or transmission that tends to upset any empirical rule and even to seriously modify scientific analysis.

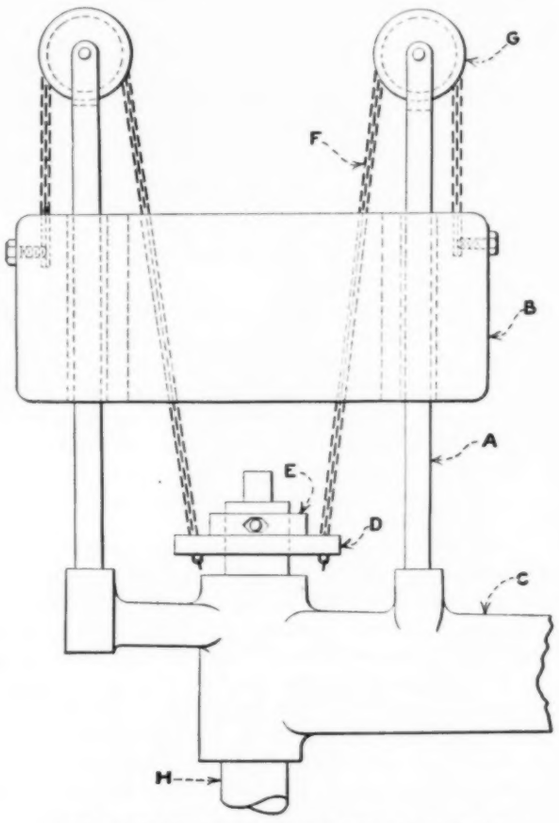
Volume of metal in the head of a piston is, up to a certain point, of value in transferring heat to the skirt. Beyond this point a thick piston head is a detriment.

There is but one safe method to employ in designing a piston to determine its correct size at any point over its entire length, and it is this: Fit a piston and rings to a cylinder with a reasonable amount of clearance based upon experience, run them in, and operate the engine under its own power. The condition of the parts when disassembled may then be observed and deductions drawn that will serve as a basis for future calculations.

A Return for a Drilling-Machine Spindle

By W. Burr Bennett

Recently the writer looked over an old plant that several years ago was a machine shop engaged in making platform scales, and in fact it still makes them from time to time as the occasion requires. Many of the machines are very old and have some curious arrangements for operating them. The writer's attention was attracted to an old drilling machine without any name



ARRANGEMENT OF THE RETURN WEIGHT

on it that had a very novel device for lifting the spindle or quill. This was in the form of a weight mounted over the axis as shown in the accompanying sketch. Fastened in the top arm of the machine frame *C* were two round steel posts *A* and on the top of these posts were located two sheaves *G*. On the top of the quill *H* was arranged a plate *D*, retained on the quill by means of a collar *E*. Two chains *F* run over the sheaves, being fastened at one end to the plate *D* and on the other to the weight *B*.

While the idea should have been to have the weight just about equal to the weight of the spindle assembly, the writer noticed that upon feeding the spindle down and then releasing it, the weight returned with a violent jerk. Is it possible that it took so much force to withdraw the drills in the good old days or was allowance made for lack of lubrication? Another thing noticed was the topheavy feature of the arrangement. The machine was lagged to a wooden floor so that any pulling or strain made the top of it sway like a mast in a storm.

Use and Abuse of Milling Cutters

By H. S. Steele

One of the most useful tools in any machine shop is the milling cutter. There is not the least doubt that it is one of the most essential tools being used today, yet if we should go into almost any shop we would find it abused in one way or another. Abused because the man who uses it knows little or nothing about either its constructions or its proper duty, except that it is there to cut with.

It is true that much has been written upon milling cutters and their duties but these writings are rarely read by the men who use cutters in their daily work, not only because they have no time to read during working hours, but because they have not enough interest in the job to read them in their homes. I do not mean that every man who uses a cutter should know all there is to know about it, but I really believe that he should know more than the majority of cutter users know at the present time.

What good is a perfectly designed, hardened and ground cutter if the man on the job knows nothing about it, except to cut with it? Most catalogs on cutters have tables of the different feeds and speeds at which they should be run and some even go so far as to publish notes on the proper clearance and lubricant to use, but the men on the job rarely have this information. They usually use their experience which is not always correct. The boss on the job may have a catalog, but he is not running all the milling machines.

Data on milling cutters are just as essential as decimal equivalents and drill speeds, both of which are made up on small compact little cards or circulars that fit into the vest pocket.

I would like to make a suggestion, and that is, that some cutter manufacturer get up a card folder containing cutter data that the man in the shop could have in his possession at all times, and before long I really believe that we would find men in the shop who would take pride in knowing the proper speeds and feeds at which to run cutters.

The folder or card that I would suggest should contain the following information:

Use high-speed steel cutters for production, as they stand up better under heavy cutting.

Use carbon steel cutters for all grades of work where fine finish is desired.

Do not burn cutters when grinding, this makes the cutting edge soft.

Grind proper clearance as follows:

For steel, 3 to 5 deg. For cast iron, 5 to 7 deg. For brass, 10 to 12 deg.

See that cutters have plenty of coolant or lubricant.

Do not use dull cutters.

Do not grind a drag or hook tooth on cutters that should be ground radially.

Do not use a fine tooth cutter where a coarse tooth cutter should be used.

Do not blame all the chatter on the cutter. Look over the machine.

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN
Editors

September 6, 1923

The Machine Tool Builder and the Service Problem

THE MACHINE TOOL builder, like the rest of us, has many problems to face but the one that is usually uppermost in his mind is how to meet the unreasonable demands of his customers for free service. So serious has the situation become that one big builder who is bringing out a new machine of radically different design is planning to abandon the direct sales method of distribution in favor of the rental plan employed by such companies as the United Shoe Machinery Corporation.

It seems rather idle to try to fix the blame for the existing conditions on either one of the parties involved. Both are at fault, the builder because his fear of his competitors has prevented him from adopting a policy of insisting upon payment for repairs or adjustments made necessary by the ignorance or carelessness of the customer's operators, the user through his failure to make provision for the maintenance of the equipment with which he carries on his business.

The question may be raised as to why the user should maintain his own tool equipment if the builder will do it for him. The answer is not far to seek. It may take two or three days or even a week or more for the builder's service man to arrive in answer to the most urgent summons. In the meantime the idle machine is down and is no longer making money for its owner. If it happens to be a "key" machine in his production chain its inaction may mean that a number of other machines must be shut down until it is fixed and the production of the whole plant slows down. Under such circumstances wouldn't it be a good investment on the part of the user to have a supply of the parts most likely to fail, and one man in his plant who had studied the machine in question so that he could attend to all but the most unlikely accidents?

Perhaps the principal reason for the continuance of the bad service situation is the conviction on the part of the short-sighted customer that the machine-tool builder is footing the bills. It may be that the builder does if he is equally short-sighted. If so, his altruism generally does not last long for his business career is soon terminated by the sheriff and then the customer is left with an orphan tool on his hands for which nobody will provide any free service. If, on the other hand, the builder knows his costs and understands where the free service will-o'-the-wisp will lead him, he will add to his price the estimated cost of the free service and the customer will pay for it in spite of himself. The injustice of this solution to the fair-minded user who pays for service as he gets it is obvious, but how is it possible to distinguish between customers when quoting a selling price? It would be entirely right to favor the man who was known to pay his way but the establishment of such a practice would be akin to patting nitroglycerine with a hammer.

What the final solution of the free service problem will be we are not prepared to say, but the establishment among machine-tool builders of an unvarying rule demanding payment for service where payment is justified would go a long way toward it.

New Equipment an Investment Not an Expense

ACCORDING to the somewhat humorous definitions of a keen observer, the difference between expense and investment depends on whether you put the money in your own business or in someone's else. If you buy new machinery or equipment for your own shop you charge it to expense. But if you let someone else use it to equip his plant or develop his business, you call it an investment.

This is unfortunately too true in many cases. Men frequently refuse to replace old and obsolete machinery with newer and more productive equipment because of the expense, and yet put the same money into stock of other companies of which they know nothing, and call it an investment. And the chances are that in most cases the same money invested in the purchase of new machines in their own business would be more truly an investment and pay higher dividends, than in any other way it could be used.

Unless your own shop already has the latest and best equipment, it should afford the best field for investment you can find. It is a business which you know far better than any other and it is where you can keep your eye on it. If it is worth continuing at all, it is worth keeping up to date by reducing production costs with the very best machinery and methods to be obtained. You cannot afford to let it fall behind because of inadequate equipment.

Consider all new machinery as an investment on the basis of what dividends it will pay in reduced costs. Remember that a $5,000 machine need save you only $800 a year to pay 6 per cent dividend and allow for a ten per cent depreciation. This is less than a saving of $3 per working day and it is a poor machine investment if it will not save more than that.

Production managers and those who keep an eagle eye on the check book, must learn that money spent for new, production-increasing machines, is not an expense but a real investment of the highest character. The best way to show faith in the stability of your own business and in your management, is to invest in the best machine equipment that can be had to handle your work. It is usually far more of an expense to put money into enterprises over which you have no control than to put it into your own plant where it can be made a paying investment. Replacing obsolete machinery with the most modern is always a good investment for any going concern.

In checking up on the savings of a new machine do not make the mistake of figuring only on direct labor. Production per square foot of floor space, keeping a supply of parts going to assembly and other factors also count in the net savings to be secured.

Shop Equipment News

Societe Genevoise Locating and Jig-Boring Machines

A series of precision machines for locating and boring jigs, manufactured by the Societe Genevoise, has recently been placed on the market by the R. Y. Fermer Co., 1410 H St., N.W., Washington, D. C. The design incorporates features based upon the experience of the builders in the construction of linear and circular dividing machines.

FIG. 1—SOCIETE GENEVOISE NO. 2 LOCATING AND JIG-BORING MACHINE

There are four sizes of the machines, of which the No. 2 and No. 5 are illustrated in Figs. 1 and 2, respectively. In all four machines a carriage, on which the work is mounted, is moved by a precision screw along accurate ways. A cross slide, also operated by a precision screw, moves at right angles to the direction or motion of the carriage. This slide carries a spindle in which may be mounted an automatic center-punch for layout of centers, a drilling tool for the preliminary drilling of holes, or a boring tool or finishing end mill for cutting holes accurately to size. A microscope may also be used to check positions on the jig or, by means of a standard scale, to check the accuracy of compensation of the screws.

The device for compensation of the screw errors is an essential feature of the machine, the correction being automatically applied to the micrometer heads. A curved template, shown in Fig. 1 attached to the front of the carriage, is cut in accordance with microscope observations to correspond to the errors of the screw, and a steel finger at the end of a lever system follows the contour of the template. The action of the finger shifts the vernier index of the head back and forth in accordance with the errors of the screw. As the screw wears new templates can be made from microscope readings on the standard scale, supplied with the machine.

It is possible to lay out and bore several holes accurately in a jig without moving the work, on account of these compensating features. On one of the larger machines, it is claimed, seven ¼-in. holes, through an 1¼-in. medium-hard steel plate, were laid out, drilled and finished in 35 min. These holes, it is stated, were accurate in diam. within 0.00016 in. and the greatest error in position of holes was 0.0006 inch.

The No. 1 machine is designed for watchmakers, has a 3-in. movement of both slides, and is provided with a work table 4 x 8 in. Machine No. 2, illustrated in Fig. 1, is designed for jigs for small machine parts, has an 8-in. movement of the slides and a 10 x 12-in work table. The lead screws have a pitch of 10 threads per in. with micrometer heads graduated to 0.0005 in. and verniers permitting readings to 0.0001 in. The tool holders have a vertical travel of 2.4 in. and three microscopes are provided, one for locating points, one for calibrating the screws, and

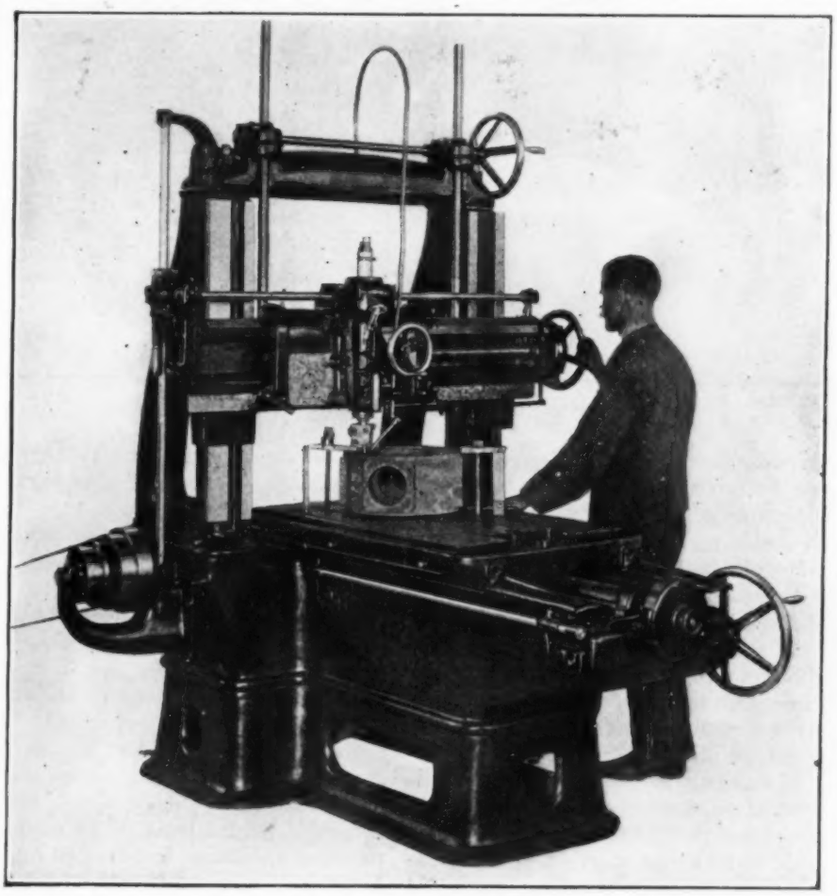


FIG. 2—SOCIETE GENEVOISE NO. 5 MACHINE

a goniometric instrument for measuring angles.

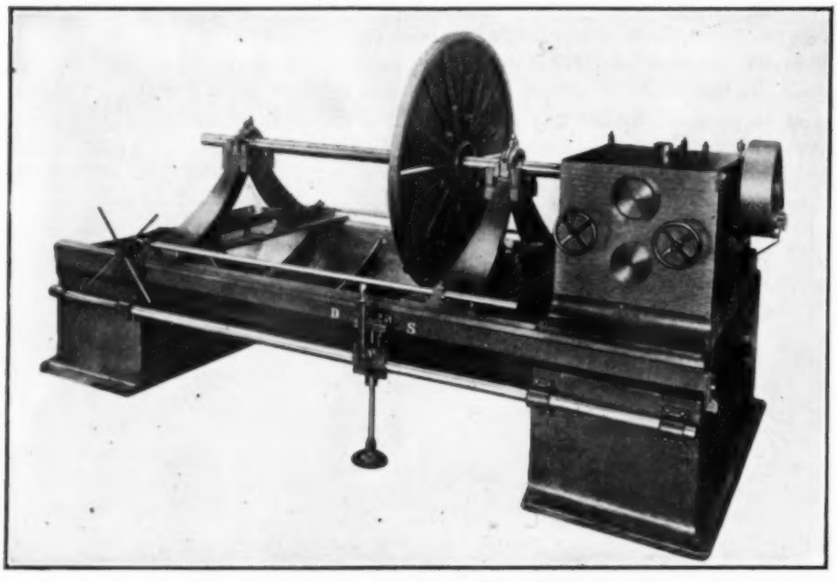
The drilling and boring attachment has a tempered spindle mounted in adjustable bearings and rotating in a carefully finished sleeve. The spindle is driven through gears by a flexible shaft at speeds from 420 to 2,000 r.p.m. Two sizes of circular tables are also provided.

The larger machines are provided with the same precision features as the smaller machines. The No. 5 machine, illustrated in Fig. 2, has a work table 40 x 24 in., and the clearance between supports is 31 in. The longitudinal travel of the table is 32 in. and the cross-travel of the tool holder is 24 in. The spindle has a No. 3 Morse taper socket and has an automatic feed with four speeds from 0.003 to 0.012 in. per rev. of spindle.

The net weight of the No. 4 machine is 2,100 lb. and of the larger, No. 5, 3,000 lb. Motors of 2 and 3 hp., respectively, are required.

Olsen-Carwen Static-Dynamic Balancing Machines

The Olsen-Carwen static-dynamic balancing machines are now being marketed by the Tinius Olsen Testing Machine Co., 500 North Twelfth St., Philadelphia, Pa., in sizes which will balance rotors up to 100,000 lb. in weight or greater, depending on the design of the part to be balanced. Features of design have been added to these machines so that they will not only indicate the amount of unbalance statically and dynamically, differentiating between the two, but will also indicate the existence of a dynamic couple and the location of the static unbalance along the length of the rotor, all without stopping the machine.



OLSEN-CARWEN BALANCING MACHINE

As shown in the accompanying illustration, the part to be balanced is mounted in plain bearings, as it is said to be unsatisfactory and inaccurate to balance rotating parts in roller or ball bearings. The bearings are bolted to a vibrating bed which is mounted on springs, and the part to be balanced is connected to the driving head which revolves it at a critical speed.

The critical speed depends upon the mass to be balanced and the spring suspension, so that if the part is balanced under this speed, it will be in balance at any speed. The amount of static and dynamic unbalance is determined in ounce-inches.

The handwheel at the right end of the driving head operates the balance weights in the machine, and an unbalance is created in the head which may be either static or dynamic, depending on the spring suspension. The static is indicated on an outer and the dynamic on an inner dial on the head. The angle or plane of unbalance is adjusted by the handwheel at the left so that the unbalance in the head is equal in amount, and opposite in angle, to the unbalance of the part being tested.

After determining the static unbalance and its angle the lever at the side of the bed is shifted from position *S* to position *D*. This changes the spring suspension of the bed so that the presence of a dynamic couple may be detected. Without changing the angle of unbalance in the head, the amount is regulated, and if the bed can be placed at rest by this means, no dynamic couple exists. The relation between the first and second readings will then determine the location of the static unbalance along the bed, and the introduction of a dynamic couple may be prevented.

When a dynamic couple is present the static unbalance is temporarily corrected on the machine, by means of a graduated disk on the front end of the spindle, until the dynamic unbalance is determined and the entire amount of unbalance corrected on the part to be balanced. The amount of metal to be added or removed from the part, and its position, are indicated by the machine.

The vibration of the bed is detected by means of the small indicator at the upper right hand corner of the driving-head housing. The spindle is of a flexible type so that no undue stresses will be placed upon the part to be balanced.

"Tuec" Truck Cleaner

A heavy service vacuum cleaner, mounted on a suitable hand truck, is now being marketed by the United Electric Co., Canton, Ohio.

The machine is for use in buildings which are not piped for vacuum service and as auxiliary equipment to the installed type. It is claimed

"TUEC" TRUCK CLEANER

that this cleaner will give as good cleaning service as the stationary plant, and it is recommended for use in factories and shops as well as office buildings and places of like nature.

The ¾-hp. motor is mounted at the top so that the fan and the armature are suspended in ball thrust bearings. A dust drawer is provided at the bottom of the separating tank and the dust bags are at the rear of the tank.

The net weight of the apparatus is 280 lb. and its height is 48 in. It is 36 in. long and 30 in. wide. The truck mounting consists of a suitable handle and 30-in. pressed steel wheels with 1-in. rubber tires.

Elwell-Parker Electric Maintenance Truck

An electric truck which will be of interest to the maintenance and repair departments of large plants has recently been placed on the market by the Elwell-Parker Electric Co., Cleveland, Ohio.

As will be noted from the illustration, a steel and wood case occupies about two-thirds of the platform of a standard Elwell-Parker truck, the balance being reserved for a motor and tool kit, with room for one or two repair men to ride. A pipe vise is mounted on the rack, which accommodates the usual emergency equipment.

The truck is equipped in this way to provide a quickly portable breakdown service, so that when the maintenance men arrive on the job, they will have sufficient tools and material for the ordinary repairs.

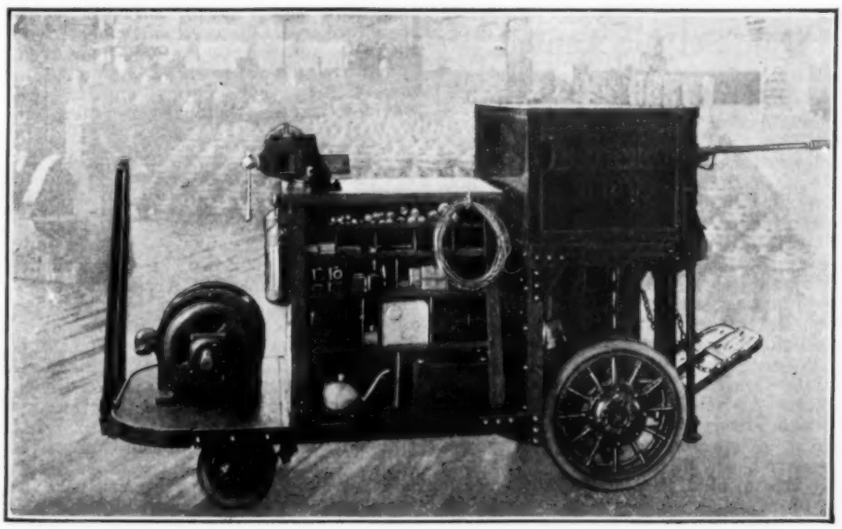
The truck has rubber-tired wheels and all four wheels steer. It is said that the simplicity of control allows anyone to operate the truck and it is, therefore, quickly available at all times.

Japan Will Be Market for Machinery

Like the rest of the world, Japan has been suffering from the general unrest following the war, according to an article in *Commerce Reports* published by the Department of Commerce. In the year 1922 imports exceeded exports; the invisible exports diminished to such an extent that the Government had to dispose of specie to the amount of 330,000,000 yen; and wages and costs still clung to their high level, while prices had dropped but slightly. These conditions led to a constant outflow of money from the country, with no corresponding influx, and caused heavy retrenchment in Japan. Many of the new industries that sprang up during the boom years and purchased machinery and supplies from the United States have found it unprofitable to operate under present conditions and have either failed entirely or closed down until things brighten in their field. This process of elimination has been rather costly and, moreover, has thrown on the Japanese market a certain amount of fairly new, used machinery, which must be disposed of before fresh imports are sought.

Notwithstanding all these factors, it must be recognized that the value of Japan's machinery business will probably never drop to the level of the average for the five years from 1909 to 1914, inclusive—12,940,357 yen. The trade in 1921 alone was 82,762,000 yen, while the total value of the trade for the five years from 1909 to 1914 amounted to only 64,701,787 yen.

Japanese industry is experiencing "growing pains," and even if these are not affecting it just at the moment, they will undoubtedly recur from time to time with reasonable frequency, and it is well for American machinery manufacturers to be prepared to alleviate these "pains" by furnishing the equipment desired for the development of business.



ELWELL-PARKER ELECTRIC MAINTENANCE TRUCK

Belgian Steel Trade Thriving

The Belgian iron and steel business maintains unusual activity although the volume of orders is limited by the fact that smelters and mills are booked to November and are accepting no commitments beyond that date, according to *Commerce Reports* published by the Department of Commerce. The market was influenced by the low offers made by Lorraine mills, by sacrificing the rebate for export granted by the Societe des Consommateurs de Coke des Hauts-Forneaux. This situation is but temporary, however, as the rebate will shortly be discontinued.

Stocks of pig iron are low and prices are rising. Production has increased considerably in July, 39 blast furnaces being in operation. The pig-iron output for July was reported as 187,340 metric tons, compared with 171,970 in June, or nearly 50 per cent over that for the corresponding month of 1922. Heavy commitments entered into by converters prevent placing any considerable contracts in semi-finished steels. The production of raw steel in July amounted to 176,000 tons, which, although it is over 55 per cent more than the output for July of last year, is somewhat under the June total of 182,000 tons. Toward the end of July prices in finished steels, which had shown some tendency to stabilize, were again pushed upward by the decline of the franc. Quotations in sterling, which are becoming extremely common, were unchanged. The output of rough castings, 5,500 tons, and that of finished steel, 144,600 tons, were both slightly under the June figures.

Pig-iron prices are generally up 10 francs per ton. Foundry No. 3 now being quoted at 475 francs and basic pig at 480 francs, the latter being in heavy demand.

More Costly but Fewer Autos Exported

Although the total value of automobile products exported during June decreased slightly from that of May, the proportion of motor cars and trucks exported remained at slightly over 8 per cent of production, states *Commerce Reports*, published by the Department of Commerce. The value of automotive exports for June amounted to $15,977,441, as compared with $17,092,041 for May—a decrease of about 6 per cent.

One of the conspicuous features of the month's figures is the increase of about 5 per cent in the value of passenger cars exported, in spite of a slight falling off in the number. While the value of trucks exported declined slightly, this decrease is much less noticeable than that of the number exported. The number of cars exported from Canada, however, increased approximately 35 per cent, and the value increased only 14 per cent. The increase in number and value of truck exports from Canada was approximately 42 and 44 per cent, respectively. The large increases in Canadian exports are explained by the fact that shipments to Australia, Great Britain, and New Zealand—markets that take principally Canadian-made cars—have shown the greatest increase.

News Section

Railway Tool Foremen Hold Convention in Chicago

Considering that the eleventh convention of American Railway Tool Foremen's Association held at Hotel Sherman, Chicago, Aug. 29, 30 and 31, was the first convention held in three years, the results obtained were very satisfactory. The convention opened on Wednesday morning with an invocation after which an address of welcome was made by Leonard J. Grossman, assistant Corporation Counsel of Chicago who was representing the Mayor. An address was also made by H. T. Bentley general superintendent of motive power of the Chicago and Northwestern R.R.

A number of papers were read and considerable discussion of great benefit was indulged in. The subjects were: forming and combination punches and dies, general tool grinding and the use of jigs on grinders, forging machine dies, jigs and devices for locomotive and car shops, general reclamation of shop tools, and shop equipment.

A theater party for foremen was enjoyed Wednesday evening and the annual banquet and entertainment was held Thursday evening. An automobile ride for the ladies was held Thursday afternoon.

Officers Elected

Seventy-six tool foremen were registered and there were forty-three exhibits of tools and devices. The election of officers took place Friday afternoon. G. W. Smith of the Chesapeake and Ohio R.R. was elected president, Charles Helm of the Chicago, Milwaukee and St. Paul R.R., first vice-president, George Tothill of the Buffalo, Rochester and Pittsburgh Ry., second vice-president, E. A. Hildegrand of the Big Four, third vice-president, C. C. Kuyper of the Illinois Central R.R., chairman of the Executive Committee, W. C. Stephenson, Atlantic Coast Line, secretary and treasurer. The next convention will be held at the Hotel Sherman again. No date has been set.

That the railroad shops are advancing rapidly along the line of modern shop practice was indicated by a paper read by R. D. Fletcher, secretary and treasurer of the association.

Mr. Fletcher's paper emphasized the importance of supervision of speeds, feeds and cuts on various classes of work. He said "the average machine foreman is kept busy routing the work and endeavoring to keep up with the erecting shop and many times while doing this overlooks the individual operator and fails to notice whether proper speed or feed is used so as to complete each job in the required length of time."

It is the opinion of Mr. Fletcher that each large shop should have a demonstrator for machine tools, should regulate shape and size of tool, also cut feed and speed on each individual job. To accomplish this a standardization of tools would be required similar to method in use in large manufacturing plants. All tools should be delivered to tool room and one or more men assigned to grind them and keep them always in good condition and ready for service. The man in charge of grinding should be furnished with a complete set of models and blue prints giving proper degree of rake, side slope, and clearance required for various kinds of work that each tool is supposed to do. Mr. Fletcher gave figures on the angles for tool grinding and the speed at which said tools should cut on various kinds of materials. He also discussed grouping of machines to expedite work by eliminating handling back and forth across shop.

Another Record Week of Car Loading

Car loadings for the week ended Aug. 18 were 1,035,741, the largest for any week in August in the history of the railroads, and with the exception of the 1,041,044 for July 28 of this year, the largest for all time. These reports brought the total figures for the first thirty-three weeks of this year up to 30,999,244, exceeding by 5,195,251 cars the corresponding period of last year.

Compared with the corresponding week last year the loadings showed an increase of 189,475 cars, or 22.4 per cent. In the Eastern district the freight loadings increased 26.3 per cent over the same week of last year, when the strikes of both the shopmen and the miners were in progress. Loadings in the Southern district increased 22 per cent, while the Western district reported an increase of but 17.7 per cent.

Date Set for Annual S.A.E. Meeting

Announcement was made last Spring that the next annual meeting of the Society of Automotive Engineers would be held in Detroit. The dates were not set at that time, but they have now been chosen definitely as Jan. 22 to 25, to co-incide with the Automobile show week in Detroit. This arrangement will enable those who attend the meeting to inspect passenger cars and trucks of the latest design many of which will come direct from the New York show to be exhibited by the Detroit Automobile Dealers' Association. The advantage of holding the S.A.E. meeting simultaneously with a representative exhibit of motor vehicles will thus be preserved.

It is expected that the 1924 meeting of the S.A.E. will be the largest in its history because of its location near the production center of the automobile industry. Engineering papers are being received at this early date and the technical meetings are expected to include the names of many experts. The meetings will be held in the General Motors Building which is becoming a convention and meeting center for the automobile industry.

Business Better in Philadelphia

A favorable business outlook throughout the Philadelphia district is reflected in the report of steel production. The mills in Pennsylvania booked more orders in July and August than they have for some time, according to figures compiled by the Federal Reserve Bank.

General manufacturing plants and railroads are buying, and automobile factories, locomotive builders and other industries have placed orders for steel castings. Sales to canners have been large, but orders for textile industries and paper mills have not been so great.

Steel rail requirements for the Pennsylvania R.R. for 1924 are estimated at 135,000 tons, which at the prevailing prices will mean an expenditure of $1,400,000. Officials are now compiling the estimated needs for the system, receiving reports and recommendations from all divisions.

Under the present plans, officials say but little new road building is in contemplation. The estimated requirements are for replacements. One new construction will be a twenty-five mile freight line from Rochester, Pa., to a point in Ohio.

The company is completing a new freight line between Allegheny and a junction with the main line near Johnstown, Pa. A new round house, costing approximately $1,000,000, will be built for the division, with sixteen stalls.

About 5,000,000 lb. of fabricated steel, used in the construction of the Broad St. train sheds at Philadelphia, have been removed. Fire recently destroyed the sheds and the steel is being removed. It will be sold for scrap at about $15 a ton. Thirty years ago when the steel was constructed, the cost was $30 a ton.

Hoover Honored by Czechoslovaks

Herbert Hoover has been elected to honorary membership in the Czechoslovak Engineers and Architects Association, it is announced by the Federated American Engineering Societies. The honor was conferred at the Annual Conference of the Association held recently at Kosice in recognition of "merit in engineering science and practice and good rendered to our people." Mr. Hoover was chairman of the Committee on Elimination of Waste in Industry, whose report has been translated by the Government of Czechoslovakia and distributed to the industries and educational institutions of that country.

Better Business Is Reported from Indianapolis

With the coming of Fall, the machinery situation has taken on a much more optimistic tone than a month ago in Indiana. Most companies in the city have about all the business they can attend to with inquiries coming in from sources that were least expected. One of the executives of one of the larger companies said the volume of inquiry for special machinery and tools was sufficient to lead to the prediction that the present Fall business will be a near record.

One of the chief sources for machinery trade now is coming from the furniture trade. For a time this Summer business was rather dull in these lines, but the last month has seen increases of from 40 to 50 per cent over business done in the Summer on woodworking machinery alone. One dull spot in the trade is the automobile industry. A month ago, business for Fall was promising, but recently there has been practically no demand from this source. The inclination most local factories are showing toward closed body jobs is making some sales for specialized machinery for this work. Unlike Detroit manufacturers, the Indianapolis automobile trade believes in making its own bodies. One well known plant that went into the hands of a receiver some months ago, is reported to have received a taxicab order for New York City that will keep the plant going for months at full capacity.

No Slump Yet

Indications are that public utility and railroad repair work will fall off during the early Winter, but there is no abatement at the present time. To the contrary there is an apparent effort to speed up the rehabilitation programs as were promised at the Spring meeting of the American Railway Association. The drastic decrease in the price of crude oil and gasoline in Indiana has virtually stopped oil developments in the fields in the Southern part of the state. Machinery men say inquiries for special drilling machinery have almost ceased.

Conditions Quiet in Cincinnati

Many of the manufacturers and dealers in machinery, in Cincinnati, have been rather surprised at the business conditions here last week. When other trades are experiencing a pleasant volume of trade, the machinists thought that their business ought also to be brisk, but such was not the case with many of them. The railroads do not seem to be interested buyers, but the automotive men are placing a fair number of orders, especially those concerns which are replacing some of their equipment. Although several of the large electrical equipment manufacturers are placing some good orders, the steel concerns are not buying much.

In the machine tool field a few of the larger electric appliance manufacturers are good buyers. Although some of the plants are making replacements with used machinery, those buyers who buy with the view of greater efficiency in their purchases, are buying maximum service planers from one of the large planer manufacturers of the city. The production of lathes is going along well in the hope that some of the orders from the electric companies will materialize. One of the men in one of the large machine tool factories in the city remarked that a preference was shown among buyers of large lathes for oil well lathes. This house, he said, was sending some 24-, 27-, and 30-in. oil lathes to California and that they were exporting a 30-in. lathe. Several small lathes, 14,- 16-, and 18-in., are being shipped to the West.

The American Tool Works made several good purchases last week including grinding machines, milling machines, radial drills and other equipment.

Manufacturers of metal specialties and steel products are enjoying a revival of trade, following the quiet period during July. The pig iron market is showing gradual improvement and prices remain firm. Production in the blast furnaces is being curtailed, with a strengthening effect on the market. Orders now being placed are for immediate shipment.

Trade Slows Down in the South

While there has been some improvement the last two weeks in machinery and machine tool sales over the Southeast, such improvement as there has been was comparatively slight, and the volume of business is still considerably less than the manufacturers and jobbers had expected. Five or six months ago there was every promise that the present year would prove one of the best the industry had ever enjoyed in the South, for sales at that time were materially better in the district than they had been in some years; since April, however, business has been dropping off considerably, with July and August the two lowest months of the year in point of sales volume. August was slightly better than July.

While Atlanta manufacturers and jobbers report they have made some fairly good sales of machinery, tools and equipment to the larger industries of the district, principally textile, as a whole the best business has been with the smaller shops and companies. If other business was in the same proportion to this there would be little cause for complaint, for the smaller shops have been doing much more buying this year than usual, principally of lathes and drilling machines. Sales of smaller and miscellaneous machine tools to the smaller shops also have been very good.

Many Inquiries

There has been considerable shopping with the trade receiving many more inquiries than usual, but with these inquiries producing comparatively little business.

The trade regards the outlook as fair for the rest of the year, much depending on the outcome of cotton. There is promise of a 12,000,000 bale crop, which is about normal, selling at an average of 25 cents per pound. If this promise materializes into a reality it is virtually certain that machinery and machine tool sales over the Southeast will improve the last three months of the year, and compare favorably with the big volume enjoyed from January to April.

New York Business Has Quiet Week

Business in the New York district took a drop during the latter part of August thereby bringing the total business for the month down below the estimates of the dealers who predicted that the month would show up favorably as compared with March and April of this year. During the past week a lull settled over the buying and it was also reported that the number of inquiries received was less than usual for the same period.

Railroads and Coal

Railroad buying has been poor during the week and many causes are given for this. Some are of the opinion that it is merely a quiet period before the heavier buying commences. Others see the coal fields problem as a factor and think that disturbances in this industry are reflected in the cautious attitude of the roads. It is enough to say, however, that railroads in the East with the exception of single purchases of absolutely necessary equipment, did not buy during the past week.

In the automotive field some selling was accomplished. Good sized orders were completed with a manufacture of a popular priced car on Long Island. Other deals were about to be closed in factories around New York making automobile accessories.

Practically no business was reported from the textile mills of New England but this was to be expected as Summer is the dull months in this industry and buying in most unusual in this quarter in August.

General industrials did some purchasing, it is reported, and there have been inquiries from these sources.

The future, however, is generally regarded as unusually bright and every dealer seems confident that the month of September will bring a return of excellent business.

North American Company Reports Gains

The North American Co. and its subsidiaries, for the twelve months ended July 31, reports gross earnings of $68,561,292, against $45,055,979 in the corresponding period of the last fiscal year. After payment of all operating expenses, and allowances for taxes, there was reported net income from operations of $24,822,534, against $15,364,310, while other income made total income of $25,203,380, against $15,787,841.

Gear Makers' Fall Meeting

The Fall meeting of the American Gear Manufacturers Association will be held Oct. 25, 26 and 27 at the Mountain House, Lake Mohonk, N. Y. Plans are being made to present many interesting papers and the list of speakers will include many prominent men.

Business Items

The Wright Machine Co. has been organized in Worcester, Mass. for the purpose of manufacturing screw machine products. George M. Wright, formerly president of the Wright Wire Co., is the president of the new company. The capitalization is for $1,000,000.

The quarters occupied by the Chicago Machinery Club, Clinton St. and West Washington Boulevard, have been enlarged by the renting of additional offices and the remodeling of the rooms.

The Logemann Brothers Co., Milwaukee, Wis., has purchased the business patents and good-will of the Chicago Baling Press Manufacturing Co., Chicago. The business will be conducted entirely through the main offices in Milwaukee and the district offices throughout the country.

The Oldsmar Automotive Accessory Corp., formed recently at Oldsmar, Fla., has taken over the large machine shop and foundry of the Oldsmar Manufacturing Co., and is converting the plant for the manufacture of several automobile accessories, according to an announcement by officials of the company.

The plant of the New Bern Iron Works, of New Bern, N. C., manufacturer of machinery and mill supplies, resumed operations Sept. 1 after an idleness of several weeks. The plant recently was sold at a receiver's sale, the various banks of New Bern purchasing the property. Eugene Williams, formerly of New Bern, heads the new company as general manager.

The Chicago & Northwestern R.R. has taken out a building permit at Madison, Wis., for new structures valued at $109,000 and other work estimated to cost $390,000, in the improvement of the Monona yards. The general contract has been let to the Charles W. Gindele Co., Chicago.

The Sullivan Machinery Co., Michigan City, Ind., that has built a new plant for the manufacture of mining and prospecting machinery, held its formal opening recently. Among the officials of the company in Michigan City for the affair were: F. K. Copeland, president; S. T. Nelson, general superintendent; A. D. Ferguson, assistant superintendent; A. E. Blackwood and H. T. Walsh, vice-presidents and Thomas W. Fry, secretary, the latter of Claremont, N. H., the home of the Eastern plant of the Sullivan company.

Federal incorporations have recently been granted in Canada to the Engineering & Inspection Co., Ltd., which is capitalized at $50,000 and whose headquarters will be in Toronto, and the Tidioute Refining Co., of Canada, Ltd., capitalized at $200,000, with headquarters at Montreal.

The Reproducto Manufacturing Co., Newport News, Va., has just erected a new plant for the manufacture of small metal parts.

The board of directors of the Van-Camp Hardware & Iron Co., Indianapolis, has elected Raymond P. Van-Camp president to take the place made vacant by the death of Cortland Van Camp. Several other changes in the personnel of the officers also were made.

The American Tool Works, Inc., Hartford, Conn., has obtained from the Vanderbeek estate the exclusive right to manufacture and sell the Vanderbeek ball and giant universal joints.

The Johnson Gas Appliance Co., Cedar Rapids, Iowa, has taken over the manufacture and sale of the Du-Moore self-cleaning rake formerly manufactured by the Moore Self-Cleaning Rake Co., Cedar Rapids, Iowa.

The general offices of the Consolidated Machine Tool Corp. of America have been removed from New York City to Rochester, N. Y. A branch sales office will be maintained in New York City.

Henry J. Bailey New President of Consolidated

Henry J. Bailey, formerly president of the Hilles & Jones Co., Wilmington, Del., has been elected president of the Consolidated Machine Tool Corp. of America to succeed the late Waldo H. Marshall, whose death occurred suddenly Aug. 23 at his Summer home, Barnstable, Mass.

HENRY J. BAILEY

Mr. Bailey has been with the Hilles & Jones Works for the past thirty-three years. He worked his way up through successive executive posts to the presidency and when this plant was combined with others in the Consolidated Machine Tool Corp. of America he was made vice-president in charge of the Hilles & Jones Works.

There is no other change in the organization. The following officers continue: Vice-presidents, H. W. Champion, formerly president of the Newton Machine and Tool Co.; H. W. Breckenridge, formerly president of the Colburn Machine Tool Co.; A. H. Ingle formerly president of the Betts Machine Co.; and J. J. Dale, formerly president of the Dale Machinery Co. O. D. Miller continues as secretary and treasurer.

Personals

F. A. WILSON-LAWRENSON has resigned from the United Carbide & Carbon Corp. and will travel in Europe for several months studying economic conditions. His resignation was due to his health which has been impaired by too close application to his duties as vice-president in charge of sales of the various subsidiaries of the company.

SHERIDAN TALBOT has been appointed secretary to the acting commercial attache at Havana, Cuba. Mr. Talbot was formerly with the International Harvester Co.

JAMES E. MILLER, Chicago, has been appointed trade commissioner of the Department of Commerce at Calcutta, India, according to announcements recently made by Secretary Hoover. Mr. Miller was formerly consulting engineer with the General Engineering & Management Corp., New York, and previous to this connection was with the Westinghouse Electric & Manufacturing Co., in United States, Canada, England, France, Russia and South America.

CHARLES A. HOWLAND, late of the Benham Engineering Co., of Kansas City, Mo., has been appointed to the technical staff of the Bureau of Municipal Research of Philadelphia. He formerly was connected with the New York State Departmet of Health.

MORRIS L. COOKE of Philadelphia has been named director of the Giant Power Survey Board of Pennsylvania by Governor Pinchot. The duties of the board are to conduct surveys of the state's natural resources for the conservation of energy and power. Mr. Cooke is a consulting engineer. He formerly held the position of Director of Public Works for the city of Philadelphia, and recently served on the Transit Advisory Board for a study of the city's subway requirements.

PERRY C. MARK, for ten years general superintendent of the Zanesville plant of the Steel & Wire Co. of America, recently acquired by the Youngstown Sheet & Tube Co., has resigned his position and will take up a new one with a construction firm at Los Angeles, Cal.

Obituary

CHARLES C. RUSSELL, aged 63 years, a pioneer in the manufacture of taps and dies in western Massachusetts, and an early inventor in the tap and die industry, died at his home in Greenfield, Mass., Aug. 27. Mr. Russell was born in Candia, N. H. His early years were mostly passed in Washington, D. C., and New York City. His first shop experience was with the John Russell Cutlery Co. In 1871 he went to Greenfield and became associated with Solon N. Wiley in the firm of Wiley & Russell, which developed a prosperous business, and merged some years ago in the Greenfield Tap & Die Corp. He retired from active business in 1912, at which time he was president and directing head of the Wiley & Russell Mfg. Co.

The Industrial Status of France

Despite the Ruhr Occupancy the country has gone ahead—Exports and imports during the past year—English building ships in French ports

By OUR PARIS CORRESPONDENT

UNQUESTIONABLY the stagnation which has settled down like a pall over France during the past three weeks is merely a manifestation of a Summer lethargy, and this in spite of the fact that the financial and economic situation, as brought about by the check in the Ruhr, is far from brilliant, indeed the price of the dollar and the pound sterling in francs are at this writing higher than ever before known.

Naturally no new obligations abroad are being assumed other than may be strictly necessary. This, however, effects merely foreign trade relations for, with the exception of the Ruhr imbroglio, there is nothing in the home situation which may be considered other than seasonable. Tax returns of the last half year are above the previous government estimates, only those items covering custom dues falling below. This again indicates the indisposition of the French trader to buy abroad at this time.

France is actually producing more coal per month than at any time since the war, during the first six months of 1923 having produced 100,000 metric tons more per month than in 1922. Iron and steel production have been on the increase for some months until these very last days when mills have been loath to book orders ahead at current rates expecting a rise in market prices due to the shutting down of the steel plants of the Ruhr and the Saar and a consequent rarefication of semi-raw materials and finished products in export markets.

On July 1 there were 106 blast furnaces alight as against 77 on April 1 in France proper and 71 as compared with 66 in Alsace-Lorraine. Pig iron production for June increased 53,585 tons over the month previous and steel bars and billets increased 39,151 tons, exceeding the production of last December, which was the largest monthly output since the war, by 12,803 tons metric.

Heavy Taxes

There is complaint on all hands of the high cost of rail transport and manufacturers of heavy lines are doubly taxed as well in obtaining their raw materials as in the distribution of the finished product. In spite of this, the railways show only normal fluctuations in freight receipts as compared with the same months of last year. There is, however, a notable curtailment of large lot shipments in the metal trades, but an increase of small fast freight shipments in contrast with a falling off of slow freight, this fact of itself accounting in some measure for the high cost of many items. This suggests that in many lines France is living on a hand-to-mouth basis as far as the final distributor is concerned. This is especially so with respect to all metal and machinery lines, the only encouraging aspect of the situation being that the wheat crop this year is sufficient to enable the country to avoid buying abroad as was necessary in 1921-1922.

A new phase of the metal industries has resulted from the occupation of the Ruhr, of which the secret has been well kept by the Interministerial Committee which was studying the results of dumping seized metallurgical products on the French or foreign markets. At the moment the problem concerns nearly six hundred thousand tons of metallurgical products of all kinds. Of this about two hundred thousand tons are highly finished products, merchant steel, profiles, wire rods, etc. The arrival of this upon the French market may well startle the French manufacturer. It is simply another situation like that of the liquidation of war stocks which in France was by no means handled with that successful facility with which such was turned back to the channels of trade in the United States. One single item alone, 25,000 tons of rails, if kept by the government and turned over to the Minister of Colonies for the laying of the Transsaharan Railway, as is proposed, will lift just that much business from French steel mills.

Export and Import Increases

France increased both exports and imports during the first six months of 1923 above the figures for the same period in 1922 by some four billion francs. Imports of manufactured articles increased 3,134,000,000 francs and exports increased by 1,361,000,000 francs. These figures are naturally misleading if compared with the normal valuation for similar articles in the years before the war, but export statistics by weight as well of French manufactured articles are in progression constantly.

It is a sign of the times that a number of minor English ship-building companies are building in France. Two causes may have led to this—the rate of exchange of practically eighty francs to the pound sterling as against a normal of twenty-five and the very obvious fact that there is scarcely more than twenty-five per cent difference between English and French output prices in certain categories of ship building, apart from fittings which are regarded as accessories which can be installed after the ship arrives at its home port. The Harfleur Works of the Chantiers et Ateliers de la Gironde has in hand two dredgers with heavy duty oil motors of 1,500 tons each for the James Dredging Co. of England. The Anglo-Saxon Petroleum Co., Ltd., has ordered a small tank steamer of 800 tons of the same company and the English Asiatic Petroleum Co. has given the Bordeaux Works of the same company an order for five oil reservoirs to be erected in Tunisian ports in competition with the Standard Oil reserves recently chased from Gibraltar by the onerous conditions imposed upon them in the transfer of fuel oil to ships in harbor. The Penhoët Works of Saint Nazaire, which built the France and the Paris for the Transatlantique line, has also just launched a dredge for the Tilbury Dredging Co. of London.

The French government Standardization Committee has, as a part of a more comprehensive program, recently issued specifications, the observance of which is obligatory on all government contracts, as well for the colonies as for mainland France. The items referred to in this latest list are:

Sheets, strips, tubes, bars and profiles of all alloyed metals of high resistance; platinum in all forms in combination with alloys or not; zinc in all forms; warps and bitts for ships; and cast deck fittings.

A clause provides that exceptions may be made in the case of the colonies where the strict following of specifications might lead to costly delays. The entire list of these specifications when completed will be the first co-ordinate effort towards a standardization program which has been made here.

It is perhaps worthy of remark that French exports to the United States of machinery, machine parts and tools during the first four months of 1923 amounted to the value of 7,824,000 francs, rather more than double the figure shipped the year before during the same period.

Chicago Prepares for Busy Fall

Machine tool sales during August were approximately in the same volume as during July. The Chicago market is inactive. The Chicago railroads are not doing any buying this week although it is understood that the Baltimore & Ohio R.R. is making inquiry for a large list. The Mobile & Ohio R.R. is reported to be in the market for a number of machine shop tools. The Sea Board Air Line Ry. is said to be preparing a rather large list of machine tools wanted. The Elgin, Joliet & Eastern made purchases last week of tools to the extent of about $85,000.

Steel producers in the Chicago district are reducing their order books for the first time in many months. While deliveries are still extended, consumers are now more certain of their shipments within a reasonable length of time than they have been at any period this year.

New business in steel was comparatively quiet during the last week, although rails and steel bars were in good demand. Despite the fact that new orders for steel are not equal to production, the outlook in the industry for the last quarter of the current year is bright. Automobile companies are still in the market for sizeable tonnages of steel, farm implement makers are fairly active and tank interests are taking fair tonnages. Automobile manufacturers are contracting for their steel up to the end of the year. One large farm implement manufacturer reports an increase in business, particularly for tractors. This maker has sufficient orders on his books for tractors to carry over to the end of the year at present capacity.

French Patents Granted in 1922

THE *Journal Official* of July 25 publishes the annual report of the French patent office which in view of the change of base brought about by the remaking of so many of the elements of the new map of Europe is exceedingly interesting.

The report refers to operations for 1922. The number of demands for patents (brevets d'invention — without guarantee of the government—S.G.D.G., as the French patent notice reads) and certificates of deposit of specifications fell, in the first classification, from 19,500 in 1921 to 17,719 in 1922 and for the two classifications together in 1922 were but 18,300.

It is stated that it must not be concluded from these figures that they indicate a diminution in industrial activity in France for during the 1921 period there were many hang-over demands from the war period which had not been disposed of. Actually the numbers of 1922 are in excess of those of 1913 by a thousand or more. The Ministry of Finance has recently increased the annual patent fees from 100 francs to 125 francs.

Of the total of 18,300 brevets and certificates delivered in 1922 those granted to French citizens were 10,879, which is a far larger proportion, as compared with those granted foreigners, than was the case in 1913, when the figures showed 9,164 delivered to foreigners and 7,562 to French citizens. Those granted to German subjects in 1922 were but 1,480 as compared with 3,967 in 1913. British subjects increased their figures in the records from 1,273 in 1913 to 1.514 in 1922. The classification "America" is represented by 2,005 grants in 1922, as compared with 1,849 in 1913, of which, states the report, "nearly all were of United States origin."

Behind in Printing

The "Office National de la Propriété Industrielle" is actually behind in the issuing of printed specifications of patents already deposited to the number of fifteen thousand odd, whereas the ordinary end of the year carry-over has seldom exceeded four thousand. A lack of appropriation funds is given as the cause, the present credit of 2,200,000 francs not permitting more than the caring for the normal annual output. Credits are requested immediately which shall permit the clearing of the decks. The former total fee of 1,500 francs, payable in annuities of 100 francs for fifteen years has, since 1921, been raised to 3,150 francs (which for the American who pays in dollars today makes his French patent cost him less than two-thirds of what it cost in the old days) which funds, in the form of annuities, are paid directly into the government treasury and not into the patent office coffers. The total receipts of 1922 were nearly ten million francs whereas in 1913 the sums so collected did not exceed five million francs.

Of the total demands for patents in 1922, approximately 13.5 per cent were held up for a year pending a final decision as to the granting thereof.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb	$0.0337	$0 0337	$0.028
Cold finished shafting	per lb	0.0433	0.0428	0 036
Brass rods	per lb	0.1741	0.1825	0.1666
Solder (½ and ½)	per lb	0.276	0.276	0.228
Cotton waste	per lb	0.1231	0.1231	0.1458
Washers, cast iron (¼ in.)	per 100 lb.	4.66	4.66	4.00
Emery, disks, cloth, No. 1, 6 in. dia	per 100	3.08	3.08	3.11
Lard cutting oil	per gal	0.575	0.575	0.575
Machine oil	per gal	0.349	0.349	0.36
Belting, leather, medium	off list	37%	37%	43½%
Machine bolts up to 1x30 in.	off list	44¼%	44¼%	53⅛%

Hendey Company Holds "Old Home Week"

The Hendey Machine Co. of Torrington, Conn., observed "old home week" Aug. 20, 21, 22 and 23, on which days salesmen from all over the country were assembled at the main plant and devoted their time to a renewal of acquaintanceship, the interchange of ideas and to a study of the products and methods of manufacture as applied to the Hendey line of machinery. The men were conducted about the factory by the company's engineers, who instructed them in the details of the several machines recently brought out and in course of development. Machines were partially taken down and reconstructed before them in order to give the men a more thorough knowledge of the various mechanisms and to put them in position to demonstrate to advantage for the benefit of their customers.

On the evening of Tuesday, Aug. 21, the party was tendered a dinner at the Waterbury Club, over which Charles H. Alvord, president of the company, presided. Mason Britton and Fred Weatherby of the *American Machinist* were present as guests.

Editors Will Broadcast From WJZ

Editors of the various papers published by the McGraw-Hill Co. are giving radio talks during September using WJZ as the broadcasting station. These talks are held on Wednesday evenings and last fifteen minutes. On Sept. 12, Kenneth H. Condit, editor of the *American Machinist* will speak on, "Automatic Machines and Their Effect on Men," on Sept. 19 a talk will be given by H. C. Parmalee, editor of *Chemical & Metallurgical Engineering* and on Sept. 26, E. J. Mehren, editor of the *Engineering News-Record* will speak on "What Engineering Is and What it Is Not." The talks start at 8:15 o'clock.

Slavs Study Methods Used in America

Close co-operation between the professional engineers of both Czechoslovakia and Poland and the Federated American Engineering Societies is being established, according to the president of the Federation, Dean Mortimer E. Cooley of the University of Michigan. Dr. Bedrich Stepanek, who recently resigned as Minister of Czechoslovakia to the United States, will spend six months in this country studying agricultural, educational, industrial and social conditions, principally in the South and West.

M. Lomchakoff of the professional staff of the Technical University of Prague is now in this country to study industrial problems, including power development, generation of gas, and the use of pulverized fuel and lignite. M. Lomchakoff is being aided in his task by officials of the Engineering Federation, the Federal Power Commission, and the U. S. Bureau of Mines. Actively interested also is J. W. Lieb of New York, past president of the American Institute of Electrical Engineers.

Engineers of Poland, it is announced by Dean Cooley, are mapping out a program of activities in which the Federated American Engineering Societies will cooperate. The Hoover assay of national waste, the investigation into the twelve-hour day in continuous industry and the study of coal storage now in progress are examples, Dean Cooley said, of engineering service in the public interest which are influencing engineers of other countries in an effort for the common good.

Pig Iron Production Breaks Record

Production of pig iron in the United States for the first half of 1923 aggregated 21,016,475 tons, according to figures compiled by the American Iron and Steel Institute. This compares with 15,028,893 tons produced in the second half of 1922 and 12,191,011 tons in the first half of that year.

The output for the first half of this year established a new high record for any similar period in the history of the country. Of the total, 20,874,240 tons were produced by the use of coke, 133,469 by charcoal and 8,766 by anthracite.

Sales Conference for Norton Men

During the week of Sept. 24 all the outside representatives of the Norton Co. will meet at Worcester, Mass., for a general sales conference. It is expected that over seventy field men will be present. The conference will be in charge of W. LaCoste Neilson, vice-president and general sales manager, assisted by H. W. Dunbar, assistant sales manager, W. T. Montague, machine sales manager, and Herbert Duckworth, wheel sales manager.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

(Copyrighted, Theodore H. Price Publishing Corporation, 16 Exchange Place, New York)

BECAUSE some Greek banditti assassinated the members of an Italian mission in Albania, Mussolini has sent a very truculent ultimatum to Athens. But the latest advices indicate that the League of Nations will succeed in composing the threatened quarrel.

The Anglo-Franco-German squabble over the reparation question is therefore about the only really dark cloud remaining on the horizon. Those who have been made pessimistic by its shadow should read the news that was cabled from Ireland two years ago and compare it with the reports of the election held there last Tuesday. In 1921 the Irishmen seemed determined to keep on fighting each other until they had committed national suicide. Today the "Emerald Isle" is the most prosperous and peaceful part of the British Empire, and the Free State administration was given an overwhelming vote of confidence at one of the most tranquil elections ever held in Ireland or anywhere else.

By thus looking backward we shall probably be able to look forward more clearly, for despite the contradictory and confusing dispatches from Berlin, Paris and London it is plain that by economic pressure the three dissentient governments are being gradually brought together and that some sort of a settlement is only a question of time.

When a settlement is reached or definitely indicated a world-wide revival in trade and industry is as certain as anything in the future can be. The markets throughout the world are already showing a subconscious appreciation of the probabilities. The London Stock Exchange is almost buoyant despite the depressing stories of unemployment cabled from the industrial centers of Great Britain, and on the Paris Bourse there has been a substantial advance in the market for the best investment securities.

While this is in part due to the depression of the franc, it also reflects the essentially prosperous condition of the French people and the unlikelihood of war. In Germany values are hard to measure with marks selling at 8 cents a million, but my private advices are that the dollar is becoming the real medium of exchange and that as its use increases business is becoming more stable.

In the Western hemisphere, both in the United States and elsewhere an increased degree of tranquility is also to be noted. It is understood that the recognition of Obregon's administration in Mexico has been practically agreed upon at Washington, and a substantial advance in the milreis is thought to indicate that the Brazilian government has been able to improve its financial condition.

There is some political irritation in Cuba over the proposed nationalization of the railways, but the latest reports are that it is being allayed. At Washington President Coolidge seems determined to avoid doing or saying anything that will disturb business, to which end he has announced that the Cabinet meetings hitherto held will be abandoned and that every effort will be made to maintain the *status quo*.

On the New York Stock Exchange the tone of the market reflects the satisfaction that is always felt by business in the assurance of political quiescence. Stocks advance more easily than they decline, and bonds are gradually working upward. It is said that over $100,000,000 of new securities will be publicly offered after the Labor Day holidays and that the bankers are confident that these offerings will be rapidly absorbed.

> "When a settlement in Europe is reached or definitely indicated a world-wide revival in trade and industry is as certain as anything in the future can be. The markets throughout the world are already showing a subconscious appreciation of the probabilities. The London Stock Exchange is almost buoyant despite depressing stories of unemployment from the industrial centers. On the Paris Bourse there has been a substantial advance in the market."

The shrewd bankers of Amsterdam are reported to be large buyers of American railway bonds and as the canny judgment of these Dutchmen is held in great respect their purchases have created a very favorable impression. Railway earnings are excellent and car loadings continue to exceed past records. Railroad securities are therefore higher, but the advancing tendency in this department of the market has been held in check by the fear that the brotherhoods may demand an advance in wages.

Governor Pinchot has probably succeeded in averting the threatened anthracite coal strike by a compromise which involves a 10 per cent increase in the miners' wages. The exact facts are not known at this writing and it is possible that public disapproval of the advance in wages suggested may make a settlement impossible.

If this shall prove to be the case the result will be an increased consumption of bituminous coal and fuel oil in the Middle Atlantic States and New England, which will probably be a blessing in disguise, for with the improvements in the methods of combustion that have been lately devised it is a question whether anthracite coal is any longer worth the premium that is demanded for it.

It is also probable that a settlement of the oil war is approaching, for the latest advices indicate a slight reduction in the output and it is rumored that the bigger companies have succeeded in securing the production that they coveted and that some of the smaller producers have been compelled to shut down. Meantime it is worth noting that the consumption of both oil and gasoline has been enormously increased by the decline in prices. A logical consequence would be an advance in the prices of petroleum and its products, in anticipation of which it may be wise for those who have empty tanks to fill them.

An improvement in the steel industry is also to be noted. It is attributed to the buying of the railways and the automobile manufacturers who are turning out an unusually large number of cars for this season of the year. Zinc is also higher, reflecting what is said to be a world wide scarcity of the metal. Copper is the only metal of importance that has declined. It has sold at 13⅜ cents on a statement showing a sensational decrease in exports.

Wheat is firmer and there are many good judges who believe that it will sell higher as the fear of a somewhat mythical surplus passes. Corn, hogs and hog products are also in improved demand, and less is being heard of the distress of the farmer. What is called an equalization of wages in the building trades is reported from many sections and a resumption of constructive activity in the East is to be noted, one effect of which is to be discerned in the announcement that 200,000,000 bricks will shortly be brought to New York from Holland.

Sugar and coffee have both been steady at prices which justify buying for legitimate consumption without being cheap enough to invite speculative purchases.

But cotton holds the center of the speculative stage. A Government report putting the condition at 54.1 and estimating the crop at 10,788,000 bales was a great surprise to the trade. It was followed by a sensational advance in futures and the indications favor a high price level throughout the season. Mill stocks throughout the world are small. The dry goods market is firm and higher. The demand for gray goods and staple lines last week was really enormous. Most mills have disposed of their unsold production and a general resumption of manufacturing activity in New England is expected.

Bullard Company Has Increased Force

The Bullard Machine Tool Co., of Bridgeport, Conn., has been obliged to largely increase its production in order to meet the demand for mult-au-matics, vertical turret lathes and continumatics, This increased capacity is being secured by gradually building up the working force with the addition of a second shift working 50 hours a week. It is the intention to still further add to the output by putting on a third shift, each working 48 hours so that within a short time the plant will assume war time activity by working "round the clock."

Catalogs Wanted

The Reproducto Manufacturing Co., Newport News, Va., desires catalogs and printed natter from manufacturers of small tools machinery, steel — especially the higher grades of non-warping die steel — and cold rolled and screw machine stock.

Pamphlets Received

Our World Trade. Foreign Commerce Department, Chamber of Commerce of the United States, Washington, D. C. Value and volume of principal exports and imports between United States and chief foreign markets is told in the recently published pamphlet.

Trade Training. The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. The methods used by this company in training its men are shown in a pamphlet that has been issued by it. The pamphlet outlines just what an apprentice does and also shows the opportunities for advancement in the electrical trade.

Invar and Related Nickel Steels. Department of Commerce. Printed by the Government Printing Office, Washington, D. C. The circular of the Bureau of Standards on this subject is a compilation of data obtained during the last 30 years by various investigators on the different properties of nickel steels.

Directory of Labor Officials. Government Printing Office, Washington, D. C. Labor officials connected with the Government in the United States and foreign countries are listed in a pamphlet that has been issued.

Statistics of Industrial Accidents in the United States. United States Department of Labor, Washington, D. C. This bulletin is a comprehensive report on the accidents in factories or wherever industry is employed. It was prepared by Lucian W. Chaney.

China, an Economic Survey. American Bankers Association. An outline of the outstanding factors of China's present day economic life and the most probable developments of the immediate future, particularly with reference to American interests.

Motorcycles, Bicycles and Parts. Government Printing Office, Washington, D. C. The results of the first biennial census of manufacturers during the calendar year of 1921.

Machinery, Textile Machinery and Machine Tools. Government Printing Office, Washington, D. C. A census of manufacture during 1921 in these industries showing complete classification and much valuable data.

Promoting Foreign Machinery Sales Abroad. Government Printing Office, Washington, D. C. Trade Information Bulletin No. 138, prepared by W. H. Rastall, chief of the machinery division of the Department of Commerce, is an exhaustive discussion of a subject that is of interest to every machine tool builder.

The Use of Statistics of Machinery Exports. Government Printing Office, Washington, D. C. Trade Information Bulletin No. 139, prepared by W. H. Rastall, chief of the industrial machinery division of the Department of Commerce tells how statistics may be used to further business.

Performance Test of Dayton Wright TA-3, Type XIV. Published by the Chief of the Air Service, Washington, D. C. Air service information circular with charts, illustrations, data and descriptive matter has been issued.

Comparative Mathematical Analysis of the Stresses Occurring in the Cam Shaft Drive Gears of the Liberty "12" and the Packard "2025" Engines. Published by the Chief of the Air Service, Washington, D. C. Air service information circular containing data, charts, comparisons and drawings relative to this subject has been issued.

Standard Method of Engine Calculations. Published by the Chief of the Air Service, Washington, D. C. This is a report of the methods adopted by the engine design branch of the engineering division, Air Service.

The Pressure Distribution Over the Stabilizer of the Vought VE-7 Airplane. Published by the Chief of the Air Service, Washington, D. C. The observation of pressure distribution over the horizontal surfaces of the VE-7 airplane at different altitudes of flight has been outlined in this pamphlet.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Automobile accessories. Warsaw, Poland. Agency. Reference No. 7524.

Automobile accessories. Santos, Brazil. Purchase and agency. Reference No. 7535.

Automobile accessories, England. Agency. Reference No. 7552.

Automobile accessories and equipment. Milan, Italy. Agency. Reference No. 7541.

Ball bearings and bearings in general, Milan, Italy. Agency. Reference No. 7541.

Metal-turning machinery. Pabjanice, Poland. Agency. Reference No. 7567.

A well known firm in Poland, Inzynier Marczynski i Spolka, Ul. 27 Grudnia Poznan, Poland, is desirous of obtaining an agency of American manufacturers of various machinery, such as metal and woodworking machinery, and also electric motors. Credit references and additional information may be obtained upon application at the American Polish Chamber of Commerce, 953 Third Ave., New York City.

The South Australian Harbor Board, Adelaide, South Australia, has issued specifications for the construction of four electric coal unloading cranes of seven-ton capacity. The time limit for the receipt of bids is to expire Oct. 30. Specifications may be consulated at the district offices of the Bureau of Foreign and Domestic Commerce in New York City, Chicago and Philadelphia.

The Min River Conservancy Board, Foochow, China, wants to buy a steam-operated river type, hydraulic dredge. The material to be dredged consists entirely of sand. The maximum capacity is to be 200 cu.yd. of sand per hour. Complete specification may be seen at any of the seven district offices of the Bureau of Foreign and Domestic Commerce.

Trade Catalogs

Chain Drive Data. The Diamond Chain & Manufacturing Co., Indianapolis, Ind. A booklet containing charts and formulas on the design and application of roller chain drives. Tables showing horsepower, working loads and speeds, and useful data on sprocket proportions, are also included.

Grinders, Buffers, Drills and Die Sinking Tools. The Stow Manufacturing Co., Binghamton, N. Y. Motor-driven tools made by this company are described in this four page folder.

Electric Hammers. National Electric Manufacaturing Co., Chatfield-Woods Building, Pittsburgh, Pa. The Syntron electric hammer is described and illustrated in this folder.

Abrasive Discs. Charles H. Besly & Co. A booklet showing various types of abrasive discs and their uses in factory production. Many testimonials as to this line are to be found in the booklet.

Flexible Insulated Couplings. The Charles Bond Co., 617-619 Arch St., Philadelphia, Pa. The Grundy patent flexible insulated coupling is described and illustrated and charts of sizes are to be found in this pamphlet. Handy ordering sheets and cable codes are also in the booklet.

Semi-Automatic Bench Milling Machine. The Weed Engineering Works, Bridgeport, Conn. A folder with dimensions of the machine, illustrations in two views and descriptive text has been issued.

Portable Electric Machinery. The R. G. Haskins Co., 520 West Monroe St., Chicago, Ill. Catalog No. 37 describes flexible shaft equipment, portable tools and labor-saving devices. How the tools may be used and a full description of them is contained in the booklet.

Vises. Athol Machine & Foundry Co., Athol, Mass. Catalog No. 36-A shows the many kinds of vises, pipe grips, bench grinders, and grindstones that are made by this company. The catalog is fully illustrated.

Induction Motors—The Reliance Electric & Engineering Co., Cleveland, Ohio. The type AA Reliance induction motors are described and illustrated in a booklet that has been issued. Charts are also to be found in the booklet.

Riveters. The Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill. Catalog No. 5 contains descriptions of many different types of riveters that are manufactured by this company. The riveters are illustrated and there are charts for the guidance of those interested.

Steam Appliances. The Atwood & Morrill Co., Salem, Mass. Catalog D and catalog E contain descriptions and illustrations of various valves and regulators that are made by this company. Both catalogs are complete and useful to engineers and works managers.

Forthcoming Meetings

International Railway General Foremen's Association. Annual convention. Hotel Sherman, Chicago, Ill., Sept. 4, 5, 6 and 7. William Hall, secretary, 1061 W. Wabash Ave., Winona, Minn.

New Haven Branch of the American Society of Mechanical Engineers. Third annual machine tool exhibit Sept. 18, 19, 20 and 21. Mason Laboratory, New Haven, Conn. A. C. Jewett, chairman.

Association of Iron and Steel Electrical Engineers. Iron and steel exposition, Buffalo, Sept. 24 to 28. John F. Kelly, secretary, Association of Iron & Steel Electrical Engineers, 708 Empire Building, Pittsburgh, Pa.

National Safety Council. Twelfth annual congress at Buffalo, N. Y., Oct. 1 to 5. All meetings will be held at the Statler Hotel. Headquarters, 168 No. Michigan Ave., Chicago, Ill.

American Society for Steel Treating. Annual convention at Pittsburgh in connection with the International Steel Exposition, Oct. 8, 9, 10, 11 and 12. W. H. Eisenman, 4600 Prospect Ave., Cleveland, Ohio, national secretary.

Society of Automotive Engineers. Production meeting at Cleveland, Ohio, Oct. 25 and 26. Headquarters, 29 West 39th St., New York City.

American Gear Manufacturers Association. Fall meeting. Mountain House, Lake Mohonk, N. Y. Oct. 25, 26 and 27. T. W. Owen, secretary, 2,443 Prospect Ave., Cleveland, Ohio.

American Management Association. October 29, 30, and 31, Hotel Astor, New York City.

National Exposition of Power and Mechanical Engineering. Second annual exposition to be held at the Grand Central Palace, New York City, Dec. 3 to 8. Headquarters, Grand Central Palace, New York City.

New and Enlarged Shops

Machine Tools Wanted

Ill., Chicago—Chicago Metal Mfg. Co., 3724 South Rockwell St.—5 to 10 ft. slip rolls, 10 or 12 in.; deep throat snears; punches; heavy sheet metal working machinery.

Ind., Jeffersonville—Quartermaster, Intermediate Dept.—precision bench lathe, drill press, drill chuck, also universal chuck.

Kan., Leavenworth—Leavenworth Battery Co.—screw cutting lathe.

Mass., Lynn—Eastern Machine Wks., 24 Marshalls Wharf, address the manager—plain type, 100 ton capacity hydraulic press; high pressure oil pump, capacity 3,000 lb. per sq. in., 250 cu. in. per minute; weight type hydraulic accumulator, about 2 in. ram with 3,000 lb. capacity (used).

Mo., St. Louis—R. C. Woodall, 3725 Garfield Ave. — lathes, drills, emery wheel, jacks, etc., for garage at 3711-17½ Garfield Ave.

N. Y., Geneseo—W. C. Ringland Garage—automobile repair equipment, to replace that which was destroyed by fire.

N. Y., Jamestown—The Chautauqua Products Co., Inc., P. O. Box 581, C. H. Johnson, Purch. Agt.—10-12-14 in. lathe.

N. Y., Jamestown—Red Star Lubricating Service, East 4th St.—equipment for proposed garage and service station.

N. Y., Medina—Colton Bros.—equipment for service station and garage, to replace that which was destroyed by fire.

N. Y., New York—United Metal Hose Co., 532 West 22nd St.—back geared screw machine, 1½ to 2 in. capacity, or to carry a 6 in. die holder.

N. Y., Rochester—Paige Sales Co., Cortland St., H. R. Stewart, Pres.—equipment for proposed garage and service station.

O., Cleveland—Weger Aeronautical Motor Co., 1391 East 49th St., C. Weger, Purch. Agt.—equipment for plant for the manufacture of motors.

Pa., Pittsburgh—J. W. McGee, 693 Preble Ave.—garage and repair equipment.

Tenn., Knoxville—Duncan Mchy. Co., 721 Central Ave., J. G. Duncan, Purch. Agt.—engine lathe, 24 to 30 in. swing, 10 to 12 ft. between centers, for sawmill repair work (used).

Tex., Jacksonville—S. J. Berry—Lathe, 18 or 20 in. swing, for machine shop.

Tex., Lufkin—Lufkin Fdry. & Machine Shop—lathe.

Va., Denbigh—J. W. Hoppes (general machine work)—Universal grinder to grind not over 2 ft. long or a piston 8 in. in diameter; lathe tool post grinder; flexible shaft grinder to carry wheel about 4 in. diameter, ½ in. face, with or without motor.

Va., Norfolk—Taylor-Parker Co., Water St. and Commerce Pl. (machinery)—engine lathe, 24 to 30 in. swing, 14 to 16 ft. centers, plain change gears, cone drive (used); shaper, 16 to 20 in. stroke; 18 to 20 in. drill press; hacksaw.

Va., Richmond—The city, Fire & Repair Dept.—machinery, including radio drill and large lathe.

Va., Richmond—L. S. Clark, Inc., 608 West Broad St.—drill press for automobile repairing.

Va., Richmond—J. G. Thompson, rear 509 West Marshall St.—drill press for automobile repairs.

W. Va., Huntington—A. C. Love Co. (machinery)—one 200 ton hydraulic wheel press to press wheels off and on trucks on small logging railroad; Bliss 5 or 5A toggle press, also Toledo 39 press.

W. Va., Logan—Guyan Machine Shops, B. Shell, Mgr.—milling machine or gear cutter for gears 2 pitch and smaller; 18 or 20 in engine lathe, 10 ft. bed; coil winding machine for field and armature coils; hydraulic press for rubber truck tires, about 250 ton; hydraulic wheel press, about 250 ton.

Wis., Fond du Lac—G. Loomis, South Main St.—automobile repair machinery, gasoline tank and pump for proposed garage.

Que., Foster—A. Bissonette—equipment for blacksmith and small machine shop.

Que., Lyster Sta.—Garage Aubre, P. A. Aubre, Purch. Agt.—garage and repair equipment.

Que., Maskinonge—A. Lemyre—garage and automobile repair equipment.

Que., Montreal—A. Emond, 374 Plessis St.—lathe and screw cutter.

Que., Riviere du Loup—A. Gagnon—automobile repair equipment.

Que., St. George's Est—A. J. Gilbert—automobile repair equipment.

Que., St. John's—Lasnier & Gallpeau, 176 Richelieu St., E. Lasnier, Purch. Agt.—garage equipment.

Que., St. Jovite—A. Ranger—automobile repair shop equipment.

Machinery Wanted

Colo., Denver—Denver Catholic Register, 203 Railroad Bldg., G. H. Astler, Purch. Agt.—35 x 48 in. cylinder press.

Colo., Parker—News—paper cutter.

Ill., Chicago—Arpinus Mfg. Co., 2601 Cottage Grove Ave. (tin shop)—36 in. square shears.

Ill., Chicago—A. Vervine & Co., 1478 State St.—acetylene welding outfit.

Ill., Decatur—H. A. Sellers, 1604 North Church St.—44 in. or 48 in. paper cutter.

Ill., Freeport—W. T. Rawleigh Co.—job press.

Ind., Butler—R. D. Higley—job press, newspaper press, pulleys, belting, bearings, hangers, paper cutter and linotype.

Ind., Evansville—Hedderich Bros., 405 Bond St.—equipment for new 1 story addition to brass foundry.

Kan., Caldwell—Messenger—7 x 11 in. or 8 x 12 in press, Gordon preferred.

Ky., Paris—Paris Gas & Electric Co.—cast iron flywheel, 14 ft. diameter, 26 in. wide; 24 in. belting.

La., New Orleans—O. K. Auto Radiator & Sheet Metal Wks., 743-745 Carondelet St., N. M. R. Umbach, Vice Pres.—4 ft. brakes, also 4 ft. rollers and shears up to ¼ in. for sheet metal use (new or used).

Me., Lewiston—Bd. Educ.—manual training equipment, including lathes, planer, drills, matcher, sander, saws, tables, benches, shafting, pulleys and belting, for new high school.

Md., Baltimore—Paper Products Co., 2405 West Franklin St., J. M. Smith, Purch. Agt.—complete equipment for proposed $350,000 plant, to replace that which was recently destroyed by fire.

Mass., Cambridge—Dixon & Fallis, 1 Dock St. (pattern makers)—belt sanding machine (used).

Mo., St. Louis—Skelly Oil Co., Russell and Thurman Aves., W. J. Skelly, Purch. Agt.—two pumps, tanks, air equipment and general accessories for oil filling station.

Mo., Seligman—Silver Lake Mining Co., T. R. Gillian, Purch. Agt.—mining machinery for steam plant.

N. Y., Buffalo—W. Allen, 119 Edson St.—wood turning lathe.

N. Y., Elmira—J. H. Waters Co., 607 John St.—machinery for proposed light manufacturing plant at 559 East 3rd St.

N. Y., Hornell—Holland Lumber Co., J. Brown and W. Phillipson, Purch. Agts.—machinery for proposed $40,000 lumber mill and woodworking factory.

N. Y., New York—L. Jeffrey Linotyping Co., 205 West 19th St.—model 5 linotype.

N. Y., New York—Logan Constr. Co., 13 Park Row—swinging engine.

N. Y., New York—New York Mchy. Co., 200 5th Ave.—hand or power operated baling machines.

N. Y., New York—Superior Auto Radiator Co., 202 West 65th St.—oxweld acetylene torch outfit.

N. Y., Pittsford—Hutchison & Clark, Inc., S. Hutchison, Purch. Agt.—apple evaporators and cider mill equipment for proposed $50,000 mill, to replace that which was destroyed by fire.

N. C., Raleigh—Raleigh Bonded Warehouse Co., N. E. Edgerton, Pres.—electric machinery for warehouse.

N. C., Ronda—Ronda Chair Co.—self feed rip saw and double disk sander.

O., Cleveland—Cleveland Laundry Co., 2840 Carnegie Ave., S. E.—complete equipment for proposed $50,000 addition to laundry.

O., Toledo—Toledo Laundry Co., Prescott St. and Ashland Ave.—machinery for proposed laundry.

Tenn., Nashville—Producers Refining Co., P. O. Box 147—44 mi. of 3 in. pipe.

Tex., De Leon—De Leon Free Press—saw trimmer and wire stitcher.

Tex., Grand Prairie—R. B. Stubbs—tire shrinker.

Tex., Hico—Printers, P. O. Box 7—one 8 x 10 in., one 10 x 15 in. and one 14 x 22 in. job press, also belting, hangers, pulleys, shafting and bearings.

Tex., Lubbock—Lubbock Cotton Compress Co.—machinery for proposed $75,000 plant.

Va., Ashland—L. N. Hank—small lathes for jewelry shop.

Va., Richmond—Prentiss Motor Co., 322 West Broad St.—machinery to replace that which was destroyed by fire.

W. Va., Harrisville—Gazette—7 column quarto press.

Wis., Green Bay—St. Joseph's Orphanage, Route 5—laundry machinery and equipment.

Wis., Madison—Chicago & Northwestern Ry. Co., c/o B. R. Kulp, Engr., 201 South Blair St.—shop equipment, small tools and 20 ton crane.

Wis., Madison—Schmidt Bros. Co., 2611 Monroe St., A. Schmidt, Purch. Agt.—gasoline storage tanks and pumps, also oil tanks and pumps.

Wis., Markesan—Cobb Canning Co., W. Sink, Pres.—canning and conveying machinery for proposed $100,000 cannery at Cobb.

Wis., Milwaukee—M. Carpenter Baking Co., 102 7th St.—mechanical baking ovens and conveyors.

Wis., Milwaukee—W. Hyink & Sons Co., 727 North Water St.—belting and shafting for proposed machine shop.

Wis., Milwaukee—Wisconsin Public Service Co., c/o J. P. Pulliam, 559 Marshall St.—gas making machinery and equipment for proposed $1,000,000 gas plant at Sheboygan.

Wis., Waupun—Bear Brand Hosiery Co.—knit goods machinery for proposed $40,000 addition to factory.

N. B., St. John—J. M. Queen Oil Co., Ltd., c/o J. A. Morris—complete refining and manufacturing equipment for petroleum oils and byproducts.

N. S., New Glasgow—W. McNeil—heavy portable sawmill.

Ont., North Bay—Temiskaming & Northern Ontario R.R., G. M. Alford, Purch. Agt.—creosoting plant for Cochrane.

Ont., Richards Landing—W. E. Owen—sawmill equipment, to replace that which was destroyed by fire.

Que., Montreal—International Hardwood Co., Ltd., c/o R. C. Grant 12 Oldfield Ave.—sawing and manufacturing equipment.

Que., Montreal—Salt's Textile Co. of Canada, Ltd., c/o G. A. Campbell, 189 St. James St.—textile machinery.

Que., Ormstown—D. Beaulieu—blacksmith shop equipment, including small tools.

Que., Rimouski—Garage St. Germain, Riverin & Chassey, Purch. Agts.—small tools, emery wheel, etc.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Iron and Steel—August steel business slower than for any previous month since October, 1921. Prices firm despite dullness of market. August iron trade heaviest since Spring. Furnaces facing higher fuel costs in event of coal strike. Coke higher. Inquiries for steel plates and shapes plentiful but mills finding difficulties in meeting delivery specifications. Plates and shapes firm at $2.50 per 100 lb., f.o.b. mill. Demand for shapes mostly in small lots. Bars firm at $2.40; demand improving.

Advances—Tin firm; up 1¼c. Lead steady; advanced ¼c. per lb. in week. Antimony and zinc sheets also firmer in New York warehouses.

Declines—Black and galvanized steel sheets lower in New York. Copper at lowest price level since October, 1922. Zinc down 35c. per 100 lb. in week. Copper sheets dropped ½c. per lb. in both New York and Cleveland warehouses. Raw linseed oil 96c., f.o.b. New York, in 5 bbl. lots, against 98c. per gal. last week.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$29.05@$31.05
Northern Basic	28.17
Southern Ohio No. 2	28.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	34.37
BIRMINGHAM	
No. 2 Foundry	25.00@27.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	29.16
Virginia No. 2	32.17
Basic	26.16
Grey Forge	26.16
CHICAGO	
No. 2 Foundry local	28.61
No. 2 Foundry, Southern (silicon 2.25@2.75)	30.51
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	27.77
Basic	26.77
Bessemer	28.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.75
Cleveland	6.75@7.40
Cincinnati	7.50
New York	5.50@7.00
Chicago	5.00@5.50

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	3.00	4.59	3.75	4.15
No. 12	3.10	4.64	3.80	4.20
No. 14	3.20	4.69	3.85	4.25
No. 16	3.40	4.79	3.95	4.35
Black				
Nos. 17 and 21	3.70	4.80	4.45	5.05
Nos. 22 and 24	3.75	4.85	4.50	5.05
Nos. 25 and 26	3.80	4.90	4.55	5.10
No. 28	3.85	5.00	4.65	5.20
Galvanized	**Pittsburgh**	**New York**	**Cleveland**	**Chicago**
Nos. 10 and 11	4.00	5.00	4.70	5.35
Nos. 12 and 14	4.10	5.10	4.80	5.45
Nos. 17 and 21	4.40	5.40	5.10	5.75
Nos. 22 and 24	4.55	5.55	5.25	5.90
No. 26	4.70	5.70	5.50	6.05
No. 28	5.00	6.00	5.80	6.35

WROUGHT PIPE (Welded)—The following mill discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
		BUTT WELD			
1 to 3	62	50½	¾ to 1½	30	13
		LAP WELD			
2	55	43½	2	23	7
2½ to 6	59	47½	2½ to 4	26	11
7 and 8	56	43½	4½ to 6	28	13
9 and 10	54	41½	7 to 12	26	11
11 and 12	53	40½			
		BUTT WELD, EXTRA STRONG, PLAIN ENDS			
1 to 1½	60	49½	¾ to 1½	30	14
2 and 3	61	50½			
		LAP WELD, EXTRA STRONG, PLAIN ENDS			
2	53	42½	2	23	9
2½ to 4	57	46½	2½ to 4	29	15
4½ to 6	56	45½	4½ to 6	28	14
7 and 8	52	39½	7 and 8	21	7
9 and 10	45	32½	9 to 12	16	2
11 and 12	44	31½			

Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 15%. Cast iron, standard sizes, 17½% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	8.00	8.00	6.55
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	5.80	5.66	5.80
Cold finished shafting or screw	4.65	3.90	4.55
Cold finished flats, squares	5.15	4.40	5.05
Structural shapes (base)	3.64	3.46	3 40
Soft steel bars (base)	3.54	3.36	3.20
Soft steel bar shapes (base)	3.54	3.36	3.20
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.64	3.46	3.30
Bar iron (3.25 at mill)	3.54	3.36	3.20
Standard tool steel	15.00	....	....
Drill rod (from list)	55%	40@55%	50%

Electric welding wire, New York, 5/32, 8.35c.; 1/8, 7.85c.; 5/32 to 1/4, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.25
Tin, 5-ton lots, New York			41.75
Lead (up to carlots), St. Louis	6.65	New York	7.37½
Zinc (up to carlots), St. Louis	6.40	New York	6.90

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	26.10	27.00	28.00
Antimony (Chinese), ton spot	8.87½	10.50	8.75
Copper sheets, base	22.75	22.00@22.50	23.00
Copper wire (l.c.l.)	16.50	19.75	16.25
Copper bars (l.c.l.)	20.75	23.00	19.50
Copper tubing (l.c.l.)	25.50	28.00	23.00
Brass sheets (l.c.l.)	18.50	23.00	18.75
Brass tubing (l.c.l.)	24.00	28.50	20.50
Brass rods (l. c. l.)	16.75	19.25	15.75
Brass wire (l. c. l.)	19.00	23.00	.....
Zinc sheets (casks)	10.75	10.45	.....
Solder (½ and ¼), (case lots)	29.50	27.75	20.00
Babbitt metal (83% tin)	52.00	49.00	38.00
Babbitt metal (35% tin)	25.00	17.00	16.00
Nickel (ingot and shot)	29.00	.....	35.00
Nickel (electrolytic)	32.00	.....	35.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	57.00
Hot rolled rods, Grade "A" (base)	55.00
Cold drawn rods, Grade "A" (base)	63.00
Copper nickel ingots	37.00
Hot rolled copper nickel rods (base)	45.00
Manganese nickel hot rolled rods "E"—low manganese (base)	57.00
Manganese nickel hot rolled rods "D"—high manganese (base)	60.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	11.50	12.00
Copper, heavy, and wire	11.50	11.00	11.25
Copper, light, and bottoms	10.00	9.00	10.00
Lead, heavy	5.00	5.00	5.50
Lead, tea	4.00	4.00	4.50
Brass, heavy, yellow	7.50	....	7.00
Brass, heavy, red	9.50	9.50	9.00
Brass, light	6.00	5.00	6.25
No. 1 yellow brass turnings	7.00	6.00	6.75
Zinc	3.75	3.00	3.75

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$23.50	$19.50	$18.50
"A" Grade:				
IC,	20x28, 112 sheets	21.00	17.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	14.00	12.60	14.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	8.25	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.11	$0.15	$0.11
Cotton waste, colored, per lb.	.08@.13	.12	.08
Wiping cloths, 13¼x13¼, per lb.	10.25	36.00 per M	.10
Wiping cloths, 13¼x20½, per lb.	....	52.00 per M	.13
Sal soda, per 100 lb.	1.65	2.25	2.65
Roll sulphur, per 100 lb.	3.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.96	1.18	1.14
White lead, dry or in oil	100 lb. kegs.	New York, 14.00	
Red lead, dry	100 lb. kegs.	New York, 14.00	
Red lead, in oil	100 lb. kegs.	New York, 15.50	
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton	$5.00@5.50	
Coke, prompt foundry, Connellsville	per net ton	6.00@6.50	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	30%	50-10%	45-5%
1½ and 1¼x3 in. up to 12 in.	15%	50%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	15%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	20%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	List net	List net	.....
Hex. head and hex. nut bolts	List net	.....	65-5%
Lag screws, coach screws	30%	.....	60-5%
Square and hex. head cap screws	60%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	25%	45%	40-5%
Bolt ends, with hot pressed nuts	30%	.....	55%
Tap bolts, hex. head, list plus	35%	.....	.....
Semi-finished nuts, $\frac{5}{16}$ and smaller	60%	.....	....
Semi-finished nuts, $\frac{3}{8}$ and larger	55%	65-10%	80%
Case-hardened nuts	40%	.. ....	.....
Washers, cast iron, ⅜ in., per 100 lb. (net)	$6.50	$4.00	$3.50
Washers, cast iron, in., per 100 lb. (net)	5.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	1.50	4.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	List net	2.75	2.50
Nuts, hot pressed, hex., per 100 lb. Off list	List net	2.75	2.50
Nuts, cold punched, sq., per 100 lb. Off list	List net	2.75	2.50
Nuts, cold punched, hex., per 100 lb. Off list	List net	2.75	2.50
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	40%	50-10%	60%
Rivets, tinned	40%	50-10%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.50	$3.90	$3.75
Cone heads, ditto (net)	5.60	4.00	3.85
1½ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
⅝ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.70 base

Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.297	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 2c. per sq.in., per ply:			
Medium grade	30-10%	30-10%	30-10%
Heavy grade	20-5-2½	30%	20-5-2½%
Rubber and duck:			
First grade	50-10-5%	50-10%	40-10%
Second grade	60-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.,			
No. 1 grade, per ream of 480 sheets:			
Flint paper	$6.30	$5.84	$6.48
Emery paper	9.90	11.00	8.80
Emery cloth	31.12	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll.	4.73	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20

Que., St. Chrysostome—P. Gagnier—equipment for garage, including emery wheel.

Que., St. Hilaire—Roy & Masse—small tools, etc., for garage.

Que., St. Hyacinthe—L. Dube, St. Rosalie St.—garage equipment.

Que., St. Hyacinthe—H. Foisy, Larocque St.—garage equipment.

Que., St. Jean Baptiste de Rouville—A. Vincelette—sawing equipment.

Que., Sorel—Sheppard & Fils, A. Sheppard, Purch. Agt.—sawmill machinery.

Que., South Stukely—A. Payette—blacksmith shop equipment.

Metal Working Shops

Ark., Brinkley—W. E. Brown awarded the contract for the construction of a 1 and 2 story, 60 x 80 ft. garage. Estimated cost $45,000. Noted Aug. 16.

Calif., Los Angeles—The Los Angeles Ry. Co., Railway Bldg., awarded the contract for the construction of a 1 story, 150 x 150 ft. garage on 16th St. Estimated cost $40,000.

Calif., Los Angeles—The Thompson Co., 1420 East 8th St., is having plans prepared for the construction of 1 story, 50 x 125 ft. garage. Private plans.

Calif., San Francisco—B. Getz, Chronicle Bldg., is having plans prepared for the construction of a 1 and 2 story garage on Ellis and Buchanan Sts. Estimated cost $40,000. Morrow & Garren, Chronicle Bldg., Archts.

Calif., San Francisco—W. W. Hanscom, Engr., 848 Clayton St., is receiving bids for the construction of a 2 story factory on 19th, Florida and Alabama Sts. for the Pelton Water Wheel Co., 19th and Harrison Sts. Estimated cost $100,000. Noted June 7.

Calif., San Francisco — J. Pasqualetti, Humboldt Bank Bldg., is having plans prepared for the construction of a 2 story garage on Market St. near 15th St. Estimated cost $40,000. Private plans.

Calif., Ventura—The Ventura Improvement Assn., c/o A. C. Martin, Archt., Higgins Bldg., Los Angeles, is having plans prepared for the construction of a 1 story, 75 x 100 ft. garage, here.

Conn., Middletown—Wilcox, Crittenden & Co., 3 South Main St., manufacturer of marine and awning hardware, awarded the contract for the construction of a 3 story, 60 x 60 ft. factory. Estimated cost $40,000. Noted Aug. 30.

Conn., Oakville—The Oakville Co., manufacturer of brass, awarded the contract for the construction of a 2 story, 70 x 120 ft. factory. Estimated cost $40,000. Noted July 26.

Conn., Plainville—The Standard Steel & Ball Bearing, Inc., awarded the contract for the construction of a 2 story, 60 x 150 ft. factory. Estimated cost $60,000.

Ill., Chicago—Boshes & Chaet, 1119 South Central Park Ave., are receiving bids for the construction of a 1 story, 125 x 125 ft. automobile sales station and garage on Arthington and Crawford Sts. Estimated cost $60,000. J. H. Klafter, 127 North Dearborn St., Archt.

Ill., Chicago—C. Botis, 105 West Monroe St., awarded the contract for the construction of a 1 story, 99 x 174 ft. garage at 425-33 East Pershing Rd. Estimated cost $40,000.

Ill., Chicago—T. Kohl, 5 North Wabash Ave., awarded the contract for the construction of a 1 story, 170 x 297 ft. garage at 6160-6220 South Wabash Ave. Estimated cost $150,000.

Ill., Chicago—N. A. and S. E. Mittleman, c/o Loewenberg & Loewenberg, Archts., 111 West Monroe St., are having plans prepared for the construction of a 1 story, 75 x 110 ft. automobile sales and service station at 2482-86 Milwaukee Ave. Estimated cost $100,000.

Ill., Decatur—The Wabash Ry. Co., Railway Exch. Bldg., St. Louis, Mo., awarded the contract for the construction of a car repair shop, here. Estimated cost $175,000.

Mass., Dorchester (Boston, P. O.)—The Shawmut Eng. Co., 24 Mills St., Boston, manufacturer of machinery, plans to build a 1 story, 50 x 100 ft. machine shop at 185 Freeport St., here. Estimated cost $25,000. E. F. Hathaway, Genl. Mgr.

Mo., St. Louis—E. T. McGrath, c/o Holbrook-Blackwelder Real Estate Trust Co., 812 Chestnut St., has purchased site and plans to build a 3 story, 89 x 110 ft. garage on Bway near Poplar St. Estimated cost $50,000. Engineer or architect not selected.

Mo., St. Louis—O. J. Popp, Archt., 320 Odd Fellows Bldg., will receive bids until Sept. 10 for the construction of a 92 x 256 ft. steel casting plant on Fairview St. for the Warren Steel & Casting Co., Fairview St. and Kingshighway. Estimated cost $50,000. Noted June 14.

Mo., Trenton — The McVey Motor Co. awarded the contract for the construction of a 1 and 2 story, 90 x 155 ft. garage on 9th St. Estimated cost $50,000.

N. J., Jersey City—The Continental Can Co., 61 Bway, New York, is having plans prepared for the construction of an addition to its factory on 16th St., here. Estimated cost $500,000. Francisco & Jacobus, 511 5th Ave., New York, Engrs. and Archts.

N. J., Newark—The A. G. Constr. Co., c/o R. Botelli, Engr. and Archt., 207 Market St., will build a 2 story, 75 x 300 ft. garage on Broad St. near State St. Estimated cost $60,000. A. Gennet, Pres.

N. Y., Brooklyn—J. Reuben, c/o S. Millman, Archt., 26 Court St., will build a 1 story, 125 x 210 ft. garage on East New York Ave. Estimated cost $50,000.

N. Y., Buffalo—The Albany Garage, 409 Niagara St., plans to rebuild its 2 story, 60 x 80 ft. garage which was destroyed by fire. Estimated cost $50,000. H. Weinstein, owner.

N. Y., Buffalo — The Becker-Hoffman Service Co., 250 Franklin St., plans to build a 3 story, 52 x 115 ft. garage on Elmwood Ave. Cost will exceed $75,000.

N. Y., New York—T. J. Keane, c/o J. G. Dunnigan, Engr. and Archt., 394 East 150th St., will build a 2 story, 100 x 100 ft. garage on 181st St. and Davidson Ave. Estimated cost $50,000.

N. Y., Rochester—The Paige Sales Co., Cortland St., plans to build a 2 story, 60 x 100 ft. garage. H. R. Stewart, Pres.

N. Y., Tottenville—The Tottenville Copper Co., Bedell Ave., awarded the contract for the construction of a 1 story, 75 x 300 ft. addition to its plant, to replace fire loss.

O., Cleveland—The Brush Garage Co., c/o Watson Co., Archts., 4614 Prospect Ave., is receiving bids for the construction of a 2 story, 110 x 110 ft. garage on Prospect Ave. Estimated cost $75,000.

O., Cleveland—A. C. Wolf & F. M. Griffith, Archts., Swetland Bldg., are receiving bids and will open same about Sept. 10 for the construction of a 1 story machine shop and foundry on East 55th St. for the Globe Brass & Mfg. Co., 5532 Perkins Ave., H. F. Schroeder, Pres. Noted Aug. 16.

Pa., Phila.—Berks Bros., Randolph and Wood Sts., awarded the contract for the construction of a 1 story, 72 x 97 ft. shop for the manufacture of ornamental and light iron, at 327 North Randolph St. Estimated cost $21,000.

Pa., Phila.—The Budd Mfg. Co., 25th St. and Hunting Park Ave., manufacturer of automobile bodies, awarded the contract for the construction of a factory on Hunting Park and Wissahicken Ave. Estimated cost $600,000. Noted Aug. 16.

Pa., Phila. — The Fleischman Co., 1223 Race St., is having plans prepared for the construction of a 1 and 2 story, 86 x 154 ft. garage and office building on 20th and Venango Sts. Estimated cost $150,000. L. L. Tieman, 693-701 Washington St., New York, Archt.

Pa., Phila.—The Ford Motor Co., Highland Park (Detroit P. O.) is having plans prepared for the construction of a 1 story, 400 x 920 ft. automobile assembly plant on 63rd St., here. A. Kahn, 1000 Marquette Bldg., Detroit, Archt.

Pa., Phila.—The R. W. Hartnett Co., 1010 Race St., is having plans prepared for the construction of a 3 story, 49 x 93 ft. factory for the manufacture of printing machinery at 1025-27 Cherry St. Private plans.

S. C., Greenville—C. O. Allen awarded the contract for the construction of a 3 story, 60 x 116 ft. garage and showrooms on East Washington St.

Tex., Dallas—The Dallas Brass Co., 4015 Main St., plans to rebuild its factory at 2870 Elm St., which was recently destroyed by fire. Estimated cost $40,000. Engineer or architect not announced.

Tex., Fort Worth — The city is having plans prepared for the construction of a 3 or 4 story garage. Estimated cost $150,000. D. M. Lewis, Engr.

Tex., San Angelo—R. P. Amacher is having plans prepared and will soon receive bids for the construction of a 2 story, 100 x 190 ft. garage. Estimated cost $115,000. J. H. Martling, 517 Massachusetts Bldg., Kansas City, Mo., Archt.

Tex., San Antonio—J. Steves, 509 King William St., awarded the contract for the construction of a 1 story garage on South Alamo St. Estimated cost $51,969.

Wis., Janesville — The Chevrolet Motor Car Co. will build a 1 story, 90 x 288 ft factory. Estimated cost $100,000. Noted July 12.

Wis., Madison — The Chicago & Northwestern Ry. Co., c/o B. R. Kulp, Engr., 201 South Blair St., is having plans prepared for the construction of a 2 story, 50 x 100 ft. machine shop, car repair shop, etc. Estimated cost $40,000. Private plans.

Ont., Oshawa — The General Motors of Canada, Ltd., awarded the contract for the construction of a 2 story, 100 x 600 ft. automobile assembly building on Division St. Estimated cost $300,000. Noted Aug. 2.

Wis., Milwaukee—W. Hyink & Sons Co., 727 North Water St., awarded the contract for the construction of a 1 story, 60 x 100 ft. machine shop on Ogden Ave. Estimated cost $40,000.

Watch The Latest Opportunities

Turn To Pages 181-195

In The Searchlight Section Of This Paper